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ABSTRACT

The first half of this report is concerned with the measurement of student achievement in reading comprehension. Following the introduction there is a brief critique of standardized, norm-referenced tests of student performance in reading. It is argued that school districts need tests that are sensitive to instructional treatments rather than more global measures of reading ability. In the section, New Measures of Student Achievement, comprehension is defined and then a multiple-choice cloze testing system is presented. In the next section of the paper the measurement of program resources is discussed. The measurement of resources utilization in units of time is offered as the most accurate, useful assessment of program resources. Finally, the work on the measurement of student achievement and program resources and methodology in productivity analyses is summarized, and a statewide survey of productivity in reading programs is proposed. The Technical Appendix provides a detailed summary of procedures, results, and survey instruments. It is written for the research specialist interested in the Main Report's conclusions. It is designed to clarify procedures and results and to present studies which will help reduce disagreement over some of the research approaches employed. (RC)

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ED118653

MEASUREMENT AND PRODUCTIVITY
IN SCHOOL READING PROGRAMS

MAIN REPORT

BUREAU OF SCHOOL AND CULTURAL RESEARCH

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THE STATE EDUCATION DEPARTMENT
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Preface

American concern with equality of educational opportunity in the 1950's and 60's and the inception of massive Federal support for education with the Elementary and Secondary Education Act of 1965 brought unprecedented attention to educational evaluation. Federal funding required the follow-up of special programs and added "accountability" to the vocabulary of education. School programs, however, failed to produce gains in student achievement as measured by traditional tests, and the demands for accountability, fanned by the current fiscal climate, have intensified. Today, educational systems must demonstrate that students are achieving or that programs can be modified to increase achievement irrespective of budgetary strictures.

Many educational researchers have become increasingly critical of the estimates of student achievement and resource utilization used in program evaluations. Legitimate productivity analyses of school programs cannot be implemented without accurate, comparable measures of student achievement on the one hand and the actual use of program resources on the other.

As a consequence of these considerations, the Bureau of School and Cultural Research of the State Education Department has directed its research and development efforts toward more appropriate and sensitive testing instruments and the adaptation of productivity analyses to school programs. Specifically, the bureau has developed an accurate, sensitive, and economical system for measuring literal comprehension, a basic skill in reading programs, and has conducted a pilot study of the feasibility of productivity analyses of reading programs. Both activities are described in this report. In addition, a statewide survey of productivity in reading programs is proposed.

Organization and Brief Summary of the Report

The first half of this report is concerned with the measurement of student achievement in reading comprehension. Following the Introduction, which places the measurement of student achievement and program resources in historical perspective, there is a brief critique of standardized, norm-referenced tests of student performance in reading. The bureau argues that school districts need reading tests that are sensitive to instructional treatments rather than more global measures of reading ability. The hallmarks of an appropriate test of student achievement in reading comprehension are discussed. In the section, New Measures of Student Achievement, comprehension *per se* is first defined, and then a multiple-choice cloze testing system is presented as an accurate, appropriate, and economical means of satisfying several evaluative needs of school districts.

In the next section of the paper, Empirical Investigations to Date, the measurement of program resources is discussed. The measurement of resource utilization in units of time is offered as the most accurate, useful assessment of program resources. In a pilot study of the feasibility of productivity analyses of reading programs conducted in the spring of 1974, the bureau demonstrated that it is possible to gather large quantities of data about the allocation of instructional time in reading programs. In addition, the study indicated clearly that criterion-referenced tests are more sensitive to the allocation of instructional time than traditional, norm-referenced tests.

Finally, in the Conclusions and Projected Research, the work of the bureau on the measurement of student achievement and program resources and methodology in productivity analyses is summarized, and a statewide survey of productivity in reading programs is proposed.

The Technical Appendix

The bureau has developed a detailed Technical Appendix to supplement the main report. The Technical Appendix is available on request from the Bureau of School and Cultural Research.

Acknowledgements

This report was written by Steven Kidder and Ted Schuder of the Bureau of School and Cultural Research. However, like most eclectic efforts of this kind, many people and institutions were involved in the research and development projects.

Herbert Kiesling, Professor of Economics at Indiana University, assisted in the implementation of the empirical investigations and analyzed data from an economist's perspective. Irene Athey, Professor of Education and Psychology at the University of Rochester, assisted in the development of the criterion-referenced test used in the empirical investigation. (Both Professors Athey and Kiesling will participate in the proposed research.) Financial support for several phases of the research came from the Carnegie Corporation of New York and the National Commission on Productivity and Work Quality. The Division of Electronic Data Processing of the State Education Department assisted considerably in establishing the data base for the study and facilitated subsequent analyses. The Computer Center at the State University of New York at Albany also helped with the initial data analysis.

Robert O'Reilly, Chief of the Bureau of School and Cultural Research, was the prime mover behind the projects and directed the many facets of the research and development efforts. Ruth Salter was responsible for the development of the literal comprehension test used to validate the multiple-choice cloze testing system. Gerlach van Gendt and Martha Zakis worked on the test administration and data collection for the empirical study. Consultants and support staff contributed to the rapid and successful completion of the work of the bureau.

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Introduction

The belief that education directly and positively affects the quality of life of the citizenry, and thereby the quality and vitality of the nation as a whole, is deeply rooted in the American consciousness. It is at least as old as Thomas Jefferson's "Letter to John Adams"[1] where the relationship between education and the state is clearly formulated.[2] Believing that a free state demanded an enlightened body politic, Jefferson recommended public funding for 3 years of schooling for all free citizens and higher education for those students with intellectual promise. To Jefferson, public education at the elementary level meant skills acquisition--reading, writing, and common arithmetic--basic skills that would allow the citizenry to gain information and, hopefully, to use it rationally in the improvement of the common weal. Beyond that simple triumvirate of educational skills, Jefferson clearly implied another aspect of education, socialization, when he stressed the *use* of both skills and information. Since Jefferson's time, publicly financed schools and their programs have certainly proliferated, but the American people have clung tenaciously to that original commitment to skills acquisition and socialization. Few public schools stray far from those broadly conceived educational goals without hazarding a public protest.

But Jefferson's expectation that public education would improve the economic, social, and intellectual lot of the citizens is an enormous burden for a modern educational system to bear. If disadvantaged citizens are educated at public expense and yet remain disadvantaged, the fault is usually ascribed to the quality of the education they receive rather than, say, to the socioeconomic system at large. But the very notion of quality in education introduces the difficult problem of measurement which has racked the educational system for the last 20 years. How do you measure quality in an educational program? And, to a public that has grown increasingly chary with its funding, how do you measure cost-effectiveness? As long as the measure of quality was restricted largely to school resources (often no more than adequate facilities), the public belief that education contributed to the improvement of life in the nation remained undisturbed. The expense of public education seemed justifiable.

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[1] Thomas Jefferson, "Letter to John Adams" (October 28, 1813) in George McMichael, *et al.* (eds.), *American Literature*, Vol. I (New York: Macmillan Publishing Co., Inc., 1974), p. 485.

[2] The belief actually predates the formation of the State of Virginia or the Nation. The Plantation at Plymouth, for instance, long before Jefferson's time, maintained a system of "public education," albeit largely religious in nature.

In 1954, however, the Supreme Court shattered that crude measure of quality--facilities--if not the assumptions upon which it was based. In Brown v. the Board of Education, the court ruled that facilities could not possibly be separate and equal. Disadvantaged peoples, who first found free access to public education following the Civil War, were still not participating in the economic and social well-being of the nation. The court seemed to reason that the fault must lie in the quality of their education. The ruling was, in effect, an attempt by the judiciary to formulate a public policy about the relationship between the quality of the entire educational experience and the quality of life in the nation. The measure of that relationship introduced by the Court, racial balance, was starkly quantitative even if it ignored other aspects of the school system. Ten years later, 98.9 percent of the Negro students in 11 southern states were still attending all-Negro schools and, therefore, as measured by racial balance, still not receiving a quality education. In 1964, Congress set out to collect data to force compliance with the law. The public trust in the ability of education to improve the quality of personal and national life was intact if not heightened by these events.

The Civil Rights Act of 1964 commissioned a survey to determine the "lack of availability of equal educational opportunities for individuals by reason of race, color, religion or natural origins."[3] The effect of Brown v. the Board of Education, then, was to force Congress, if not the educational system, to confront the difficult problem of measuring quality in education. The survey used some of the most sophisticated measurement devices and analytical methods available at the time, and the ensuing report, Equality of Educational Opportunity (hereinafter called the Coleman Report), was an attempt to provide an accurate description of school resources and to estimate the effect of those resources on student achievement. Coleman concluded that the study "has had its major impact in shifting policy attention from the traditional focus on comparison of inputs (the traditional measures of school quality used by school administrators: per-pupil expenditure, class size, teacher salaries, age of building and equipment, and so on) to a focus on output, and the effectiveness of inputs for bringing about changes in output."[4] But the results of the survey were wholly unexpected: there appeared to be almost no relationship between the quality of the school and student achievement.[5] Major reanalyses of the original data have both confirmed and denied the findings. To the public, the report seemed to indicate that schools did not affect student achievement a great deal, and the easy trust between the citizenry and the educational system was seriously disrupted for the first time since Jefferson proposed publicly financed schools.

[3] R. Gordon McIntosh, et al., eds., "Introduction," Equal Educational Opportunity (Cambridge: Harvard University Press, 1970), p.3.

[4] James S. Coleman, "The Evaluation of Equality of Educational Opportunity" in F. Mosteller and D. Moynihan (eds.), On Equality of Educational Opportunity (New York: Random House, 1972), pp. 149-150.

[5] Frederick Mosteller and Daniel P. Moynihan, "A Pathbreaking Report" in On Equality of Educational Opportunity, op. cit., p. 15.

Cost-effectiveness immediately became an issue: were the public expenditures under Title I of the *Elementary and Secondary Education Acts* and the *Headstart* projects ill-advised? Was there, in fact, any relationship between the quality of expensive school resources and the scholastic achievement of the students? "The Coleman Report, its progeny and the stream of negative Title I evaluations have gradually eroded the assumptions underlying compensatory policy"[6] and "comforted those who would reduce the resources allocated to education."[7]

The Coleman Report, however, ran counter to intuitive assumptions about the effect of schooling. (If a child never went to school, how well would he perform on a 12th grade New York State Regents Exam in Physics? How would this child's performance compare to the performance of a student who majored in science and never missed a day of school from kindergarten to 12th grade?) Recent critiques of the Coleman Report have focused on the measure of student achievement used in the report: was it a measure of "achievement" or rather of "aptitude"? (Schools can hardly be held responsible for aptitude.)[8] The difficult problem of the measurement of program resources and student achievement has in fact become one of the major areas of educational research since the Coleman Report. "Prior to 1964, for example, no more than a few hundred thousand dollars were spent annually on educational program evaluation. But by 1970, the Federal Government was spending some five million dollars a year."[9]

[6] David K. Cohen and Michael S. Garet, "Reforming Educational Policy with Applied Social Research," *Harvard Educational Review*, 45 (February, 1975), p. 23.

[7] David E. Wiley and Annegret Harnischfeger, "Explosion of a Myth: Quantity of Schooling and Exposure to Instruction, Major Educational Vehicles," *Educational Researcher*, 4 (April, 1974), p. 7.

[8] Schools do, of course, affect aptitude, but not in clearly definable ways. Inherited abilities are not easily separated from abilities that are influenced by environment.

[9] Cohen and Garet, *op. cit.*, p. 18.

How can the productivity of essential school programs, like reading, which consume vast amounts of Federal and state funds,[10] be measured? More to the point, in light of recent criticism of the educational system, how can productivity be measured in terms of cost-effectiveness? The problem of measurement in such a productivity analysis is twofold: (1) how to measure program resources in terms of dollars per hour per student, and (2) how to measure student achievement in terms of course content and objectives. Solutions to these two measurement problems would make it possible to determine the information and skills acquired during a given period of time, knowing the cost of each unit of time. Program efficiency would be a measure of the ratio of achievement to time spent. Student achievement could then be maximized by manipulating program resources in comparison to achievement. With such a continuous productivity analysis, local program managers would have unprecedented cost- and efficiency-control over their own programs to the benefit of students, teachers, the educational system in general, and, of course, the public at large.

Most attempts to measure program resources heretofore have ignored a major contributor to student achievement, namely the actual quantity of schooling. And yet no other aspect of school resources is so easily subject to measurement or quantification. The obvious exceptions to the general tendency to ignore quantity of schooling as measured by units of time are the economists, like Kiesling,[11] who traditionally use measures of time in productivity analyses. The importance of measuring time was also noted by Carroll early in the 1960's when he devised a model of school learning with the actual amount of time spent in learning as the major determinant of student achievement.[12] More recently, Bloom[13] and Wiley and Harnischfeger[14] have extended Carroll's model by incorporating school, teacher, and student characteristics (e.g., teacher sex, student age, and instructional materials). When such a generalized model is refined and applied to the complexities of a particular instructional program, however, the investigator has to measure the actual minutes per week that an individual student is exposed to every instructional mode within the program (e.g., whole-group, individualized, and paid-aide instruction).

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[10] Riverside Research Institute, for instance, has recently estimated that New York State alone "spends at least a billion dollars a year on reading related instruction." *Design Concepts for a Measure of Effectiveness in Reading: A Feasibility Study*, prepared for the New York State Education Department (September, 1973), p. 1.

[11] Herbert J. Kiesling, "Input and Output in California Compensatory Education Projects," RAND Corporation R-781-CC/RC, 1971.

Before such data about the quantity of instruction and other program resources can be related to student achievement, however, the difficult problem of developing an accurate measure of student achievement that is directly related to the objectives of the instruction must be solved. Considerable research has been done since the Coleman Report on the measurement of student achievement in reading. A clear distinction has been made between tests which measure student aptitude and tests which measure student achievement. The productivity analysis described in this paper compared the sensitivity of a traditional norm-referenced test to the sensitivity of an experimental criterion-referenced test as measures of student achievement. The pilot study and the experimental test resulted in a clear conception of what a test must be like to measure student achievement in reading. The Bureau of School and Cultural Research is currently developing such a test for field-testing this spring and fall. When validated, the achievement test will be combined with accurate measures of program resources to study the productivity of reading programs in New York State.

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[12] John B. Carroll, "A Model of School Learning," Teachers College Record, 64 (1963), pp. 723-733.

[13] B.S. Bloom, "Time and Learning," American Psychologist, 29 (September, 1974), pp. 682-688.

[14] Wiley and Harnischfeger, op. cit., pp. 7-12.

Traditional Measures of Student Performance

As noted in the Introduction to this paper, productivity analyses of reading programs depend upon accurate, valid measures of student achievement. With rare exceptions,[15] however, major evaluations of reading programs have relied on standardized, norm-referenced tests like the California or Metropolitan Achievement Tests to measure student achievement (program output) in reading comprehension. Though standardized, norm-referenced tests certainly have a place in educational testing,[16] there are at least five critical problems in using them to measure student achievement in reading comprehension: (1) they are rigid in format and costly; (2) they are not objective enough in construction to be reproducible; (3) the scaling properties of the tests make the scores difficult to interpret; (4) the tests are insensitive to individual gain or growth; and (5) they lack validity as a measure of comprehension *per se*.

Format

Commercial firms design and develop most of the standardized, norm-referenced tests that public school systems depend on. The design, construction, and validation of these tests is time-consuming and requires considerable expertise (as well as what some commentators call "artistry"[17]), so they are, of course, expensive testing instruments.

Part of the salability of these costly tests lies in their format: they come in pre-assembled packages that are easy to administer. But it is precisely that inflexible format which is the source of their limited utility and, as a consequence, their enormous hidden costs. The rigid format, for instance, containing only a few parallel test forms, permits only one simple evaluation design, a pre- and a post-test. Moreover, because the pre-packaged tests cannot be taken apart and reassembled to construct a test of appropriate difficulty for an individual student or a particular group of students, standardized, norm-referenced tests yield only an imprecise measure of achievement. (In order to measure student achievement in reading accurately, the test administrator must assign the student to a test form with a level of difficulty which is very close to the student's actual level of reading achievement. The more the test varies in difficulty from the student's actual reading ability, the more imprecise the measure of that ability.) Since standardized, norm-referenced tests are inflexible in format, since they contain few parallel test forms, and since each form covers many levels of difficulty (e.g., a 4th grade student may face 10th grade reading materials), it is nearly impossible to measure an individual student's reading achievement accurately. Rigid test formats, then, are not only inherently expensive, but they prevent school systems from implementing satisfactory evaluation designs.

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[15] Notably Lee H. Hansen and Karl D. Hesse, *A Pilot Reading Literacy Assessment of Madison Public School Students: Final Report* (Madison, Wisconsin: The Madison, Wisconsin Public Schools, The Department of Research and Development, 1974).

[16] Primarily as predictors of academic success.

[17] F.B. Davis, *Educational Measurements and Their Interpretation* (Belmont, Calif.: Wadsworth, 1964), p. 262.

Objectivity

To be useful in measuring reading achievement as part of a productivity analysis, a test must be objective enough to be reproducible. That is, several test writers working independently with the same corpus of materials must be able to produce essentially the same test. What this means in practice is that test writers, while selecting the materials to be included in the test and writing questions about those materials, must follow a detailed, explicit rules system (somewhat like a computer program) which radically limits the opportunity to make subjective decisions based on personal biases and idiosyncrasies. Several advantages are gained by such objectivity: (a) if the test is reproducible, there is an objective basis for claiming that two different forms of the test should have the same label (e.g., "reading comprehension"); (b) it becomes possible to examine otherwise arbitrary claims about what the test actually measures, for its genesis is public and traceable; (c) it also becomes possible to compare the results of two different tests in relation to the reading skills being measured; and (d) different forms of the same test can be used to monitor reading development over short periods of time.

Unfortunately, test development procedures for standardized tests of reading comprehension fall far short of this kind of objectivity. Publishers have developed a careful, traditional procedure for constructing standardized tests, but subjectivity is apparent at every stage of the process. Test writers begin, for instance, by developing an outline of the information the test will cover. But since "the outlining procedure is ill-defined, it is difficult to verify that an item measures the content claimed by the label."[18] Once the content is selected, the test writer is constantly making subjective decisions about which questions to write. Some questions are rejected as too easy; others are too difficult, or too wordy, and so on. The result, as Bormuth has commented, is that the test writer is "implicitly designing the test" as he goes along, "but doing so in a manner that is not open to inspection and ... review."[19] Perhaps it is precisely the relevant course content that is present in the final form of the test, but the substantial lack of objectivity makes verification impossible.

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[18] John R. Bormuth, On the Theory of Achievement Test Items (Chicago: The University of Chicago Press, 1970), p. 12.

[19] Ibid., p.13.

Scaling Properties

To be useful in measuring gain or cost-effectiveness, an achievement test must produce scores on a scale with equal intervals and a meaningful zero point. A ruler, for instance, is a measurement device with equal intervals and an absolute zero. An inch at either end of a ruler is still an inch, or an inch in linear space is equal to any other measure of one inch in linear space. But part of the "meaning" of that measure of one inch is the possibility of zero length or no inches. The interval of one inch is an absolute measure that does not need to be transformed for comparison with another measure in inches. Once a test is developed to measure gain on a scale with equal intervals and a meaningful zero point, it becomes possible to interpret the raw score as a true quantitative measure of gain or growth within individual students over a period of time.

In addition to equal interval scaling and a meaningful zero point, a useful test development procedure must be based on person-free item calibration and item-free person measurement. Such a procedure would result in test scores that could be interpreted in terms of an absolute scale (person-free) rather than in relation to the particular students who took part in the original calibration of the test. The procedure would also produce test scores that would not be dependent on the particular items used on the test (item-free). Person-free and item-free tests in reading comprehension would result in a measure of achievement on a scale from "little ability" to "maximum ability." Interpretation of raw scores would be referenced directly to this equal interval, meaningful zero scale. Equivalent and parallel test forms could then be assembled for accurate, periodic testing. School districts could compare the effects of different educational treatments on individual students or groups of students, and cost-effectiveness studies would be feasible.

But norm-referenced tests do not have these scaling properties. Instead, test scores are referenced to the particular group of students used to norm the test. The estimate of reading ability these tests produce is dependent upon particular people and the specific content of the test. Comparisons between test scores on different forms of the test are made difficult, in part, because the content of the two forms is not comparable. Raw scores cannot be interpreted because there is no meaningful zero point and no equal interval scale. Standardized, norm-referenced tests, therefore, cannot produce accurate measures of achievement and cannot be used effectively to evaluate reading programs.

Sensitivity

Rather than assessing gain within individuals, standardized norm-referenced tests are designed to "measure the stable, between-individual differences that traditionally have been of primary interest to psychological testing."[20] The design principles of such tests, that is, are psychometric (rather than edumetric[21]); they deliberately maximize individual differences. For example, questions that most students answer either correctly or incorrectly are eliminated from the tests in the experimental stages. The most efficient question, for purposes of differentiating between individuals, has a passing proportion of .50 (or .625 when corrected for guessing). The tests, then, are referenced to a norm group rather than to an absolute criterion; they are "so constructed that at each grade level they attain a normal distribution of test results."[22] The reliability is determined by internal consistency and the *stability* of response to the same test administered at two different times. Any sensitivity norm-referenced tests might have for measuring gain or growth within individuals over the period of a school year is systematically eliminated in the item-selection process. Standardized, norm-referenced tests, that is, are *designed* to be insensitive to achievement. As a consequence, they are also insensitive to differences in educational treatments and cannot be used effectively to evaluate reading programs.

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[20] Ronald P. Carver, "Two Dimensions of Tests: Psychometric and Edumetric," American Psychologist (July, 1974), p. 512.

[21] Edumetric tests are designed "to measure the gain or growth of individuals." Ibid., pp. 512-518.

Validity

Standardized, norm-referenced tests are validated by correlations with other standardized, norm-referenced tests. Considering the brief discussion of objectivity and sensitivity above, the circularity of the validation process is apparent.

Moreover, there is good reason to suspect that the conceptualization of comprehension *per se* behind these tests is faulty. For instance, traditional, norm-referenced tests of reading comprehension "purport to measure how well a student understands what he is reading. The questions used to ascertain the degree of this understanding are based on the tacit assumption that a direct relationship exists between reading a passage and answering questions about it."[23] Weaver and Bickley tested that assumption with samples from many standardized tests of reading comprehension. They discovered that college students who had not read the passages upon which the questions were based answered 67 percent as many questions correctly as those who had the passages.[24] Obviously, many questions were not passage-dependent. The passages, that is, were not the only sources of the information needed to answer the questions. A more recent study of passage-dependency by Tuinman in grades 4, 5, and 6 found that the "average probabilities of correct responses with no passage present ranged between .32 and .50--well above the expected chance score of .25."[25] (The norm-referenced tests used in this study were (a) The Nelson Reading Test, (b) The California Achievement Test, (c) the SRA-Achievement Series, (d) The Metropolitan Achievement Tests, and (e) The Iowa Test of Basic Skills.) These studies indicate that reading comprehension scores on traditional, multiple-choice tests are grossly affected by the knowledge that students bring to the testing situation. These norm-referenced tests can hardly be accurate measures of "reading comprehension" if students can answer significant proportions of the questions correctly without bothering to read the passages.

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[22] Harry Singer, "Measurement of Early Reading Ability: Using Norm-Referenced, Standardized Tests for Differential Assessment of Progress in Learning How to Read and in Using Reading for Gaining Information," paper presented at the Conference on Early Reading Tests at Georgetown University, August 20-22, 1973, p.4.

If not achievement or comprehension per se, what then do standardized, norm-referenced tests in reading comprehension actually measure? A test constructed to maximize discriminatory power will emphasize aptitude at the expense of achievement.[26] In reading comprehension, such tests emphasize general verbal ability and thus correlate highly with tests of intelligence. In the upper grades especially, these reading tests include more and more tasks like those found on intelligence tests; "hence it is understandable why correlations between reading and intelligence tests increase as children progress through the grades."[27] If "reading comprehension" tests are in fact measures of general verbal ability or aptitude and as such correlate highly with intelligence tests, it is not surprising that educational treatments hardly affect the results of those tests. Schools can be held accountable for gains resulting from instruction, but they cannot be held responsible for the intelligence of the students. School systems need an accurate measure of reading achievement based upon a clear conception of what reading comprehension is and which aspects of comprehension can be effectively taught in formal instruction.

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[23] J. Jaap Tuinman, "Determining the Passage Dependency." Reading Research Quarterly, Vol. 9 (1973-74), p. 208.

[24] Wendell Weaver and A.C. Bickley, "Sources of Information for Responses to Reading Test Items," APA Proceedings, 75th Annual Convention (1967), pp. 293-294.

[25] J. Jaap Tuinman, op. cit., p. 206.

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[26] Richard C. Anderson, "How to Construct Achievement Tests to Assess Comprehension," *Review of Educational Research*, Vol. 42, No. 2 (Spring, 1972) p. 165.

[27] Harry Singer, *op. cit.*, p. 4.

New Measures of Student Achievement

Defining Literal Comprehension

Educational systems will always be held accountable for teaching students minimum reading comprehension skills, skills that will enable students to participate as adults in a literate society. (This does *not* imply that schools will or should stop teaching more sophisticated comprehension skills.) Adults must be able to "comprehend" the written materials they encounter in their daily lives (e.g., newspapers and magazines, employment information and application forms, consumer and citizen information). Indeed, basic literacy has become a national priority--witness the Right-to-Read Program.

At the moment, however, educational systems do not have tests which can disentangle the measure of minimum skills in reading comprehension from estimates of general verbal ability or intelligence. Not only are there no tests to measure minimum comprehension in reading, but experts cannot even agree about the number of subskills involved in the complex phenomenon called "comprehension."[28] Given this state of affairs, some clarification of terminology and practical decisions about the number of measurable skills in comprehension are in order.

For purposes of conceptualizing the *process* of comprehension, the commonly accepted definition is the logical starting point: comprehension is the act or process of grasping the meaning of a verbal message. "Meaning" is the key word in this definition. A test of comprehension must get at the student's grasp of "meaning." The obvious implication is that the test-maker must first identify the "meaning" or, more generally, the kinds of meanings (e.g., literal or inferential) that are to be grasped.[29]

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[28] F. B. Davis, "Psychometric Research on Comprehension in Reading" in F. B. Davis (ed.), *The Literature of Research in Reading with Emphasis on Models* (U. S. Office of Education: Targeted Research and Development Program OEC-0-70-4790, Project No. 0-9030, 1971).

But meaning is itself a difficult concept. Brown defines meaning, in its broadest sense, "as the total disposition to make use of and react to" a linguistic form.[30] The reader must make use of every aspect of a linguistic form: "ed," for instance, when added to the verb, stridulate, changes the "meaning" of stridulate; but any further meaning that may be derived from stridulate is dependent upon the reader's knowledge of the relationship between stridulate and other forms of verbal and non-verbal experience. The dictionary defines stridulate, renders it meaningful, by relating it to other forms of verbal experience. The meaning of stridulate finally resides, however, in the relationship between the word and specific kinds of behavior of certain insects. Stridulate, then, is a symbolic representation of non-verbal experience. In effect, context, in its largest sense--perceived connections between linguistic forms and other forms of verbal and non-verbal experience--determines meaning, and context necessarily extends beyond the immediate group of linguistic forms in which a word may happen to appear on one of its occasions. The "total meaning" of a particular word would thus refer to a complete history of its usage or its symbolic representations. But language is not only symbolic; it is also arbitrary: context, though necessarily expansive, is also necessarily limited or societally standardized. Society, for instance, judges some contexts to be inappropriate (e.g., smiling pencil or fatly happening--disregarding "poetic license") and arbitrarily excludes some usages from the "total meaning" of a word. Meaning is thus societally standardized. Even that limited context, however, can be enormous in the case of particular words. "Rat," for instance, may "mean" quite different things to "rat psychologists" or families who live in urban ghettos.

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[29] John B. Carroll, "Defining Language Comprehension" in Roy O. Freedle and John B. Carroll (eds.), Language Comprehension and the Acquisition of Knowledge (New York: John Wiley and Sons, 1972), p. 10.

[30] Roger Brown, Words and Things: An Introduction to Language (New York: The Free Press, 1958), p. 109.

The first step in defining minimum comprehension, then, is to limit meaning, and meaning is limited by reducing context. Carroll has suggested that it might be possible "to separate several 'pure' comprehension factors (depending, respectively, on lexical knowledge, grammatical knowledge, and an ability to 'locate facts' in paragraphs) from an inferential factor requiring the examinee to go beyond the data given."[31] The implication is that "comprehension may be regarded as a process that contains at least two stages: (a) apprehension of linguistic information, and (b) relating that information to wider context."[32] It is worth repeating that context, though it can be limited, can never be reduced to the words in any given written message; the words, in and of themselves, are meaningless unless they represent other verbal or non-verbal forms of experience. Even the simplest comprehension involves considerable knowledge of grammar and the lexicon beyond what is immediately evident in the message. But Carroll's point is well taken. Extending context by making inferences involves an accumulated body of knowledge as well as mental skills that are slow to develop. Schools, in fact, may have little effect on the growth of such skills.[33] Indeed, many students never develop critical comprehension skills; they may never be able to derive sophisticated inferential meanings from written materials, yet they can certainly attain "basic literacy."

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[31] Freedle and Carroll, op. cit., p. 8.

[32] Ibid., p. 13.

[33] Robert H. Ennis, "Children's Ability to Handle Piaget's Propositional Logic: A Conceptual Critique," Review of Educational Research, 45 (Winter, 1975), pp. 1-41.

In light of the foregoing, minimum comprehension is conceptualized as literal comprehension: the act or process of grasping the explicit, societally standardized meaning of a verbal message.

> This line of argument suggests that an 'adequate' comprehension of a message at the time of its reception may be achieved by the comprehension of just that linguistic information that is 'committed' to the message in terms of its own structure and in terms of whatever information has been disclosed by virtue of previous context.[34]

The context, then, is restricted, insofar as possible, to the explicit statements of the particular message under scrutiny. Inferential and metaphorical meanings are radically reduced in the conception of literal comprehension outlined here. The comprehension factors depend on grammatical and lexical knowledge and the ability to locate "facts" in the message. Literal comprehension, though limited, is not only teachable but intellectually and socially useful, for it is fundamental to any other derivation of meaning from the message.

For testing purposes, meaning must not only be derived, but it must be exhibited. A good test of literal comprehension would be a word-for-word or a summary paraphrase of a given message. Such tests, however, are difficult to construct objectively, and they are expensive, even in the multiple-choice format. What is needed is a proxy for a test by paraphrase, a test that gets at the student's grasp of meaning by reference to words in limited contexts rather than complete paraphrases. The cloze technique seems to offer possibilities for measuring literal comprehension objectively and inexpensively.

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[34] Freedle and Carroll, op. cit., p. 12.

The Cloze Technique

The cloze technique is derived from studies in Gestalt psychology on the human tendency to "cloze" or fill in gaps in any perceptual pattern in such a way as to maintain the symmetry of the perceived pattern. For example, a blank in the following series of numbers--1, 2, 3, _, 5, 6--is perceived as the number, 4. Though Taylor adapted the cloze technique to the reading field more than 20 years ago,[35] it has never been fully realized as a flexible, economical, and accurate testing device in reading. In fact, the cloze technique, insofar as it has been used at all, has generally been used to measure readability. In accuracy and general prescriptive value, it has proven to be far superior to conventional readability formulas based on sentence length and difficulty of vocabulary.[36]

When the cloze technique is used to measure readability, five to ten passages 250 words or more in length are randomly selected from the first, second, and third sections of a printed text. Every fifth word is then deleted, and the incomplete text is presented to the student who tries to fill in the missing words. Only exact replacements (minor misspellings excepted) of the missing words are counted as correct answers. There is no time limit to the test. The student's ability to produce the correct words is a function of the difficulty (readability) of the text for that particular student. Average scores from a group of students yield an accurate measure of the readability of particular printed materials for those students. Other readability formulas do not generally yield scores that can be directly referenced to specific instructional materials and a particular student population.

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[35] W.L. Taylor, "'Cloze Procedure': A New Tool for Measuring Readability," Journalism Quarterly, 30 (1953), pp. 415-433.

[36] T.C. Potter, A Taxonomy of Cloze Research, Part I: Readability and Reading Comprehension (Los Angeles: Southwest Regional Laboratory for Educational Research and Development Tech. Rep. No. 11, 1968).

Using the standard cloze technique to measure readability, however, is tedious and time-consuming. The tests have to be scored by hand. Furthermore, readability barely taps the potential uses of the cloze. For instance, deletion of a particular part of speech (e.g., prepositions) may yield a measure of language development. On the other hand, deletion of nouns, verbs, adjectives, and adverbs--words which carry most of the informational burden of a sentence--may produce a measure of literal comprehension as defined in this paper: the act or process of grasping the explicit, societally-standardized meaning of a verbal message. In the standard cloze technique used to assess readability, any word is deleted, irrespective of part of speech, and the scores correlate substantially with traditional reading comprehension tests.[37]

The rationale for regarding the cloze as a measure of reading comprehension is rooted in the regularity of language. For example, verbs are usually preceded by noun phrases (nouns, pronouns, and modifiers), or articles like "the" are usually followed by nouns, adjectives, or adverbs (e.g., "the happily married man"). Thus a student faced with a gap in the following sentence--"the _______ car careened madly down the hill"--has enough syntactic cues to know that the missing word has to be an adjective. The ability to predict words in connected discourse demonstrates at the very least a low level of literal comprehension based upon grammatical knowledge. Further, in conventional usage, some words are more likely to occur in conjunction with other words for semantic as well as syntactic reasons. Cars careening madly down hills, for instance, are more likely to be "runaway" than, say, "supercilious" even though both words can perform the functions of an adjective as required by the grammatical context. Thus the cloze technique also measures lexical meaning, another factor in literal comprehension. Knowledge of factual content, the third factor in literal comprehension, is more difficult to measure early in a verbal message. The ability to predict factual content (e.g., names, dates), however, increases with the length and coherence of the message. For example, it might be impossible to tell if a character's name were "Pickle" or "Frank" early in a narrative, or whether he weighed 1[illegible]2 or 310 pounds, but once those facts were established, they would generally remain consistent through the rest of the narrative.

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[37] John R. Bormuth, "Cloze Test Readability: Criterion-Reference Scores," *Journal of Educational Measurement*, 5 (1968), pp. 189-196.

In general, because both the reader and the writer share common experiences with language, the reader is able to predict the missing words in the writer's message. The more familiar the content and the more redundant the style and the content, the more easily the reader comprehends the message. Thus the ability to predict successfully a significant proportion of the writer's message in a cloze test is indicative of the reader's comprehension of the message.

Prediction of the missing words in connected discourse, it should be noted, is based on probability rather than certainty. Particular words, that is, are more likely to occur in particular syntactic and semantic contexts than other words. Even so, guessing the missing words on a cloze test is similar to current notions of what the reading process seems to be like. Goodman, for example, has described reading as a "psycholinguistic game":

> Efficient reading does not result from precise perception and identification of all elements, but from skill in selecting the fewest, most productive cues necessary to produce guesses which are right the first time. The ability to anticipate that which

> has not been seen, of course, is vital in reading, just as the ability to anticipate what has not yet been heard is vital in listening.[38]

In a report published in 1971, Bormuth attempted to validate the cloze as a proxy for tests of reading comprehension.[39] Bormuth conceived of comprehension as information gain, measured by comparing pre- and post-test scores. Using a standard cloze format--passages 250 or more words in length, any-word deletion--Bormuth compared the cloze scores to more traditional fill-in or completion comprehension questions on the same or comparable passages. The relationship between the information gained from the passages and the cloze scores is shown in FIGURE 1 as a series of curves for each grade level. Note that below a cloze score of 35%, there is little or no information gain at any grade level. As the cloze scores advance beyond 35%, students are able to gain increasing amounts of information from the passages. The curves continue to rise steeply to a peak of about 70% on the cloze scores. The average raw score on the cloze is then converted to a percentile figure and interpreted as follows:

Cloze Scores	Reading Level
0% to 34%	Frustration Level Material
35% to 49%	Instructional Level Material
50% and above	Independence Level Material

Students who score below 35% are judged non-literate in regard to the material in question. Those students who score between 35 and 49 percent can gain information from the materials with instructional aid. Above 50 percent, students can gain information from the material independently. (As noted

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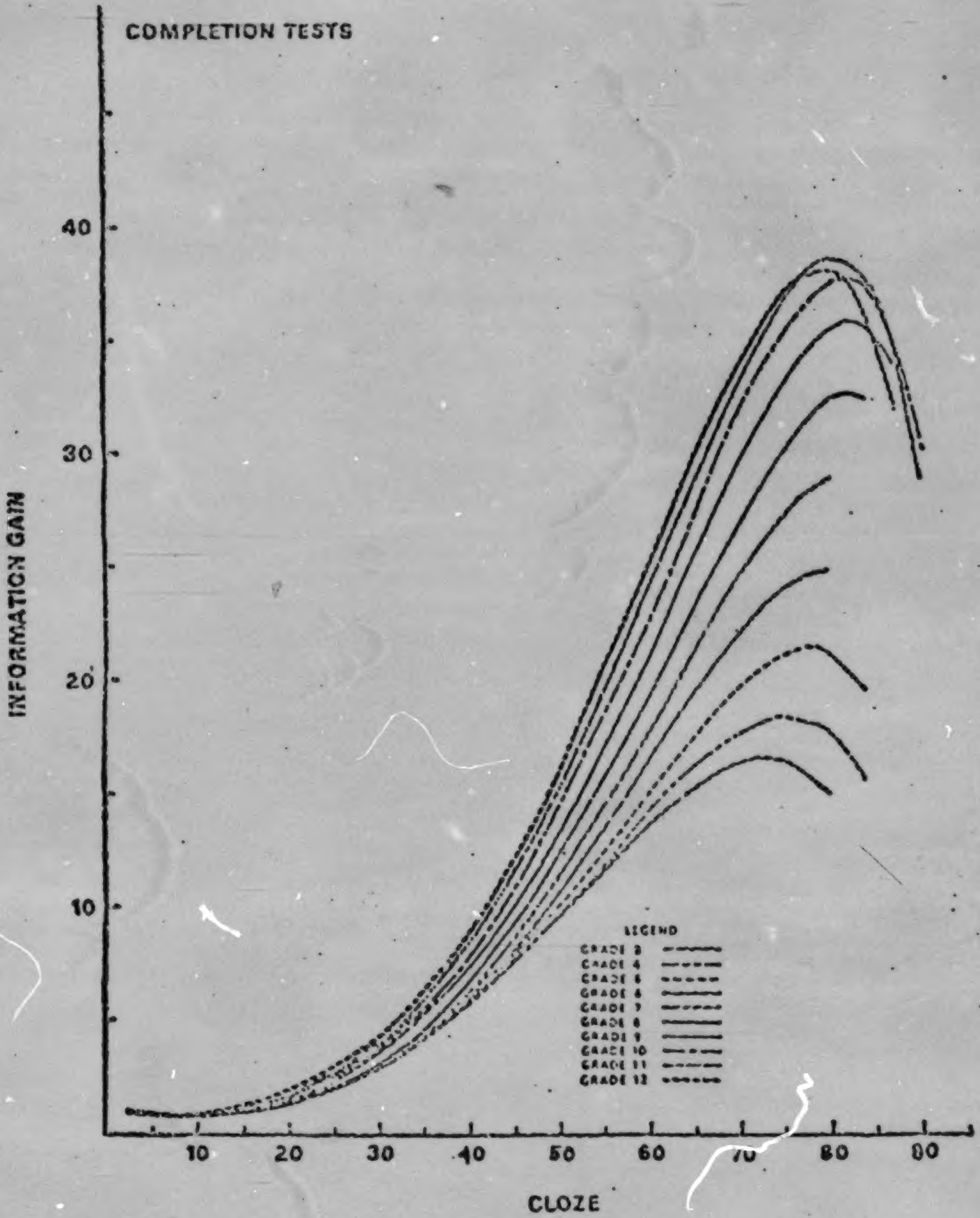
[38] Kenneth S. Goodman, "Reading: A Psycholinguistic Guessing Game" in H. Singer and R. Ruddell (eds.), Theoretical Models and Processes of Reading (Newark, Del.: International Reading Association, 1970-71), p. 260.

[39] John R. Bormuth, Development of Standards of Readability: Toward a Rational Criterion of Passage Performance, Final Report (U.S. Office of Education: Project No. 9-0237, 1971).

FIGURE 1

Regression of Information Gain Scores on Cloze Scores[40]



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[40] *Ibid.*, p. 102.

above, neither conventional readability formulas nor standardized tests of reading comprehension yield such clear-cut interpretations.)

The foregoing discussion illustrates in part how cloze scores might be used to measure reading comprehension in general. What is needed in practice, however, is a variation of the standard cloze technique that will disentangle the measure of literal comprehension from more general reading comprehension skills involving inference. In addition, an objective sampling technique is needed so that the cloze test can be referenced directly to the materials that students are expected to read at any given level in school. The tests must be easy and economical to construct, requiring no particular expertise in language or testing, and allowing for the development of parallel or equivalent test forms to monitor achievement in comprehension over relatively short periods of time. Finally, the format must be multiple choice so that the tests can be scored by machine. The cloze testing system developed by the Bureau of School and Cultural Research meets all these criteria.

The Cloze Testing System Developed by the Bureau

Selection of Cloze Passages. In order to eliminate the possibility of content bias and to assure that these tests would reflect the materials students actually read in instructional programs and elsewhere, a plan was devised for random sampling of four domains:

1. Textual Material in Reading, Language Arts, Social Studies, Science, and Mathematics;
2. Citizen Material (newspapers and news magazines);
3. Consumer Material (catalogs, advertising, instructions, and so forth); and
4. Reference Materials (test instructions, children's magazines, encyclopedias, and so forth).

The sources of these materials were the New York State Education Department's Curriculum Laboratory and the State Library. Some consumer passages were taken from A Pilot Reading Literacy Assessment of Madison Public School Students.[41]

The samples taken were examined to locate coherent passages of specified lengths appropriate for clozing. Readability scores were then calculated and the passages assigned to grade levels. (As noted in the preceding section of this paper, the cloze is itself superior as a measure of readability to the conventional formulas described below. Consequently, conventional readability formulas were used only as rough, preliminary guides for placing the passages at appropriate levels of difficulty for field-testing.)

The readability formulas used were the Spache[42] and the Dale-Chall.[43] The Spache is normally used for grades 1 through 3, the Dale-Chall for grades 4 through 12 and college. Both formulas use average sentence length and percent of "hard words" in calculating difficulty. "Hard words" are those not appearing on lists of familiar words. The word list for the Spache formula is "Clarence Stone's Revision of the Dale List of 796 Easy Words"; for the Dale-Chall formula it is the "Dale List of 3000 Familiar Words." (The criteria for difficulty used in devising both formulas were graded reading materials.) The Spache formula produces grade level scores. The Dale-Chall formula produces raw scores interpreted as "corrected grade levels." The corrected grade level for a raw score of 5.0 to 5.9 on the Dale-Chall, for example, is 5th to 6th grade.

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[41] Hansen and Hesse, op. cit.

[42] G. Spache, "A New Readability Formula for Primary-Grade Reading Materials," Elementary School Journal, 53 (1953), pp. 410-413, and Good Reading for Poor Readers (Champaign, Ill.: Garrard Press, 1960).

[43] E. Dale and J. Chall, "A Formula for Predicting Readability: Instructions," Educational Research Bulletin, 27 (1948), pp. 37-47.

The range of Spache scores was divided into six equal intervals, and the range of Dale-Chall scores was divided into 22 equal intervals. This gave 28 difficulty levels covering grades 1 through college. The raw scores, difficulty levels, and original grade level interpretations given by Dale-Chall and Spache are shown in TABLE 1.

The selection procedures resulted in 1,494 passages for cloze testing. Their distribution by domain and grade level is shown in TABLE 2. TABLE 2 also shows the distribution of the textual materials by subject matter.

Preparation of Cloze Items. The procedure for word deletion in the cloze passages varied with grade. For grades 1 and 2, every eighth word was deleted. Deletions were limited to nouns and verbs. For grade 3 and above, every fifth word was deleted. Deletions included adverbs and adjectives as well as nouns and verbs.

In all cases, the initial deletion was made between the sixth and the 10th words. The exact starting point was determined by a table of random numbers. The number of deletions per passage was fixed by the passage length, which varied by grade level. The number of alternatives in the multiple-choice responses also varied by grade level: three alternatives at grade 1, four at grades 2 and 3, and five at grades 4 and above. These variations by grade level are summarized in TABLE 3, Specifications for Cloze Passages and Test Items.

The correct multiple-choice response to a cloze item is the exact word deleted from the passage. To assure distractors of appropriate difficulty for the test items, graded lists of nouns, verbs, adverbs, and adjectives were prepared using Harris and Jacobson's Basic Elementary Reading

TABLE 1

Difficulty Levels for Cloze Passages

Readability Formula	Raw Score	Difficulty Level	Original Grade Level Assignment by Spache and Dale-Chall
SPACHE	1.0 - 1.4	1	1
	1.5 - 1.9	2	
	2.0 - 2.4	3	2
	2.5 - 2.9	4	
	3.0 - 3.4	5	3
	3.5 - 3.9	6	
DALE-CHALL	4.50 - 4.74	7	4
	4.75 - 4.99	8	
	5.00 - 5.24	9	5-6
	5.25 - 5.49	10	
	5.50 - 5.74	11	
	5.75 - 5.99	12	
	6.00 - 6.24	13	7-8
	6.25 - 6.49	14	
	6.50 - 6.74	15	
	6.75 - 6.99	16	
	7.00 - 7.24	17	9-10
	7.25 - 7.49	18	
	7.50 - 7.74	19	
	7.75 - 7.99	20	
	8.00 - 8.24	21	11-12
	8.25 - 8.49	22	
	8.50 - 8.74	23	
	8.75 - 8.99	24	
	9.00 - 9.24	25	13-15 (College)
	9.25 - 9.49	26	
	9.50 - 9.74	27	
	9.75 - 9.99	28	

TABLE 2

Passages for Cloze Testing

Grade	Domain									Grand Total
	Textual						Citizen	Consumer	Reference	
	Reading	Lan.Arts	Math.	Sci.	Soc. St.	Total				
1.	48				30	78				78
2	40				30	70				70
3	30	20	20	20	20	110			10	120
4	42	20	20	20	20	122			9	131
5	37	20	20	20	20	117	3		10	127
6	33	20	20	20	20	113	6	8	12	133
7	30	20	20	20	20	110	12	9	11	136
8	30	20	20	20	20	110	18	9	10	142
9	30	20	20	20	20	110	35	15	10	154
10	34	20	20	20	20	114	37	11	10	152
11							37	13	8	38
12							38	13	10	42
13							30	12		28
14							24	10		23
Total	354	160	160	160	220	1054	240	100	100	1494

TABLE 3

Specifications for Cloze Passages and Test Items

	Grade 1	Grade 2	Grade 3	Grade 4 and Above
Passage Length	25-35 words	40-45 words	60-70 words	60-70 words
Words Deleted	Nouns verbs	Nouns verbs	Nouns Adjectives Verbs Adverbs	Nouns Adjectives Verbs Adverbs
Frequency of Deletions	Every 8th Word	Every 8th Word	Every 5th Word	Every 5th Word
Deletions per Passage	3	5	10	10
Alternatives per Item	3	4	4	5

Vocabularies[44] and EDL Research and Information Bulletin 5: A Revised Core Vocabulary.[45] Special content lists of words for subject matter areas like Social Studies were compiled using the Harris-Jacobson material and the American Heritage Word Frequency Book.[46]

Initially, distractors were selected from appropriate lists by use of a table of random numbers. Later, a computer program was written for automatic random selection of distractors. Each set of distractors was reviewed to eliminate tricky or ineffective distractors, such as synonyms, and to assure that the distractors agreed with the stem in tense, number, and so forth.

With a minimum of 3 deletions per passage at grade 1 and a maximum of 10 deletions per passage at grade 4 and above, nearly 15,000 multiple-choice items have been prepared for the cloze testing system.

Format. All cloze passages and test items have been put in a comparable format. The format gives (1) the identification number of the passage, (2) a title (provided by the item writer), (3) the passage itself, and (4) the test items. Large (Bulletin) type is used for the first two grades. A sample cloze passage for grade 8 is shown in FIGURE 2.

Advantages. The multiple-choice cloze testing system being developed by the Bureau has several important advantages over standardized, norm-referenced tests of reading comprehension. Its primary advantage lies in its specificity--rather than attempting to assess a confusing hodgepodge of

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[44] A. Harris and M. Jacobson, Basic Elementary Reading Vocabularies (New York: The Macmillan Company, 1972).

[45] S. Taylor, H. Frackenpohl, and C. White, "A Revised Core Vocabulary: A Basic Vocabulary for Grades 1-8, An Advanced Vocabulary for Grades 9-13," Research and Information Bulletin No. 5 (Huntington, N.Y.: Education Development Laboratories, 1969).

[46] J. Carroll, P. Davies, and B. Richman, The American Heritage Word Frequency Book (New York: Houghton-Mifflin, 1971).

FIGURE 2

Sample Cloze Passage and Items

THE CHEST SAVES THEIR LIVES

The wind blew freshly, and drove the ____1____ away from the shore, and the ____2____ billows tossed it ____3____ and down; while Danaë ____4____ her child closely to her ____5____, and dreaded that some ____6____ wave would dash its ____7____ crest over them both. The ____8____ sailed on, however, and neither ____9____ nor was upset; until, when ____10____ was coming, it floated so near an island that it got entangled in a fisherman's nets.

①
- a. instrument
- b. register
- c. energy
- d. chest
- e. variation

②
- a. uneasy
- b. special
- c. indigo
- d. light
- e. husky

③
- a. conveniently
- b. really
- c. exclusively
- d. up
- e. highly

④
- a. stitched
- b. clasped
- c. halted
- d. mooed
- e. tangled

⑤
- a. atlas
- b. bosom
- c. knock
- d. application
- e. applicant

⑥
- a. next
- b. big
- c. fluffy
- d. legal
- e. racial

⑦
- a. moral
- b. remarkable
- c. foamy
- d. stranded
- e. heroic

⑧
- a. concord
- b. patter
- c. chest
- d. wrist
- e. push

⑨
- a. whisked
- b. sank
- c. returned
- d. educated
- e. entitled

⑩
- a. thing
- b. maize
- c. menu
- d. night
- e. clearance

cognitive skills, the multiple-choice cloze is designed to measure a carefully delimited aspect of reading, literal comprehension. Not only is literal comprehension vital to more sophisticated interpretations of verbal messages, but it is construed in this paper as very close to notions like "basic literacy," thereby establishing its social as well as its academic value. By means of the multiple-choice cloze testing system, the definition of literacy can be referenced directly to whatever materials school districts decide their students ought to be able to read. "Basic literacy" can thus be defined in terms of specific reading materials. The possibilities for flexibility on the one hand or uniform standards on the other are evident.

Two characteristics of the design and development of the testing system make it possible to determine whether or not the tests actually measure literal comprehension: objectivity in construction,* and the passage-dependency of the items. Passage-dependency is inherent in the design of the testing system. Without reading the passage, the student has little basis for choosing among the graded lists of nouns, verbs, adjectives, or adverbs that comprise each set of responses. For example, how would a student identify the correct answer in the following responses:

a. whisked
b. sank
c. returned
d. educated
e. entitled

And yet if the student can read the passage and understand the semantic context surrounding the missing word, he or she should have little difficulty in choosing sark as the correct answer: "The chest sailed on, however, and neither ______ nor was upset" (from FIGURE 2).

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*A more complete description of the actual construction of the testing system is available on request from the State Education Department, Division of Research, Bureau of School and Cultural Research, Albany, New York 12234.

In contrast with norm-referenced tests that purport to measure "reading comprehension," the multiple-choice cloze testing system is designed to measure achievement rather than general verbal aptitude. The tests, that is, are sensitive to gains within individuals rather than differences between individuals. The test scores are an accurate assessment of the acquisition of specifiable kinds of meanings from specific kinds of printed texts. The tests, therefore, should be sensitive to differences in instructional treatments of both short and long duration.

This precision in measurement results in the second major advantage of the testing system--its flexibility. The testing system can be used to estimate an individual students' gain in literal comprehension of specific instructional materials over relatively short periods of time, or it can be used to compare the efficiency and cost-effectiveness of different reading programs. With modifications, the testing system can be used to measure readability (for placement purposes), language development (for diagnostic purposes), and either literal or general comprehension.

But this kind of flexibility depends on a scaling system with equal intervals and a meaningful zero point. In addition, the testing system must yield estimates of achievement that do not depend on the particular passages or items used, or the specific students used to scale the difficulty of the passages. In order to accomplish these objectives, a modification of the Rasch procedure will be used.

To calibrate the difficulty of the passages, two sets of passages and items containing some passages and items in common will be given to two different groups of students. The two sets of passages will then be calibrated separately. "The resulting calibrations will represent two scales with equal measurement units but different origins ... because the origin of the ... [passage] calibration scale is arbitrarily set equal to the average ... [passage] easiness."[47] The two different scales will then be adjusted by adding a constant to the difficulty value for each passage on the less difficult test. This will result in one scale origin for both tests.

An example helps to clarify the procedure.[48] Assume that Test A and Test B share three passages. The average difficulty value of the three passages on Test A is 55. On Test B, the same three passages have an average difficulty value of 45. To adjust the calibrations in order to equalize the scale origins, it is necessary to add a value of 10 to the difficulty value of the passages on Test B. This procedure references all passages to the same scale of reading achievement. The result is person-free passage calibration. (This same procedure can be used to scale reading passages across subject areas like science and language arts.)

Another advantage of these procedures lies in the ability to anchor the scale of reading achievement at low levels of literal comprehension. This can be accomplished because the passages in the multiple-choice testing system have already been roughly scaled for difficulty using the Spache and Dale-Chall readability formulas. This scale provides an initial reference point for low difficulty passages. Through several applications of the Rasch scaling procedures, it will be possible to anchor the common origin for these passages at a meaningful zero point (i.e., the easiest passages that students with the lowest comprehension ability can comprehend).

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[47] R. Robert Rentz, "Applications of the Rasch Model: Test Equating and Score Interpretation," Educational Research Laboratory, University of Georgia (photocopy), p. 4.

[48] This example is taken from R. Stiles, W. Hathaway, and F. Foster, "Use of the Rasch Model with Content Referenced Tests," paper delivered at the American Educational Research Association Annual Meeting (Washington, D. C.: March 31-April 3, 1975), p. 2.

Thus the objectivity of test construction and the scaling procedure make it possible to produce numerous parallel test forms for continuous monitoring of achievement in literal comprehension or productivity analyses. The testing system is extremely flexible, and flexibility is the key to the third major advantage of the multiple-choice cloze testing system--its economy. One system satisfies a variety of the evaluative needs of school districts.

Validation. The Bureau is currently field testing the multiple-choice cloze tests, and the field tests will continue through the 1975-76 academic year. A concerted effort will be made to determine whether or not the experimental tests can in fact separate the measure of literal comprehension from more sophisticated inferential processes. The testing system is designed to measure the student's grasp of the explicit, societally standardized meaning of the printed, verbal message. Performance on the multiple-choice cloze tests will be compared to performance on several other tests designed to measure various aspects of reading comprehension.

The preliminary investigation of the validity of the multiple-choice cloze tests was initiated in the spring of 1975. In this new study, performance on the experimental cloze tests will be compared to performance in

1. sub-tests or selected items from the California Achievement Test (e.g., items that measure grammatical, lexical, or inferential meaning),
2. a cloze test where students have to supply the missing words, and
3. a criterion-referenced test (described below) designed by the Bureau especially for validating the multiple-choice cloze test.

The assumption in comparing the multiple-choice cloze tests to specific items on the California Achievement Test is that the experimental cloze will have a high positive correlation with those items on the norm-referenced test that measure grammatical and lexical meaning. On the other hand, relatively lower positive correlations are expected with those items on the California Achievement Test that involve inferential processes and higher levels of reading comprehension.

Since the California Achievement Test is a standardized, norm-referenced test, it has a limited utility for validating the multiple-choice cloze system. Consequently, the bureau developed another criterion-referenced test comprised of passages with main idea and detail questions to help clarify what the multiple-choice cloze test actually measures. The Bureau set up specifications for the passages in terms of length, difficulty of style and concepts, variety in style and subject matter, quality (e.g., coherence), and reader interest, and then selected and edited passages from existing tests, books, and magazines. In addition, many passages were written to the test specifications. The process resulted in 300 passages at 20 levels of difficulty from grades 1 to 10, or 15 passages per level. The passages were assigned to levels of difficulty using the same Spache and Dale-Chall readability formulas that were used to place the multiple-choice cloze passages.

Main idea and detail questions were written on each of the 300 passages, using an explicit rules system to reduce writer bias. The title and main idea questions necessarily involved inferential processes, but inference was kept to a bare minimum by limiting title and main idea responses to explicit words or statements in the text.

The detail questions--who, what, which, when, where, why, and how--were adapted from Bormuth's On the Theory of Achievement Test Items.[49] The questions were based on minimal transformations of clauses from the passages. The exact wording of the original statement in the passages was reproduced insofar as possible in the question. For example, "obsequious men write tricky questions" would be transformed into "what kind of men write tricky questions." Distractors had to be grammatically and semantically plausible and were also taken directly from the passage whenever possible. FIGURE 3 is an example of a passage and questions.

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[49] Bormuth, op. cit.

Of the three factors involved in literal comprehension--grammatical and lexical knowledge and the ability to "locate facts" in a verbal message--this test will certainly measure the first and third factors. The example above should make it obvious, however, that it is possible to answer the question without knowing what "obsequious" means. Therefore, the test may not be an adequate measure of lexical meaning. Vocabulary and words-in-context items from the California Achievement Test will be used to validate the measure of lexical meaning on the detail questions.

The overriding criterion for every item was that it be impossible to answer the question without reading the passage. Consequently, passages with a high degree of familiarity (e.g., the Columbus story) were eliminated. In addition, items without passages will appear on Part II of the test forms to verify passage-dependency.

During the preliminary study of validity conducted in the spring of 1975, only the detail questions (the least inferential) will be compared to the multiple-choice cloze test. Additional studies of validity will take place during the fall and spring of 1975-76. At that time, the multiple-choice cloze test will be compared to other tests of literal comprehension (e.g., paraphrase) and inferential processes.

The Test Development Notebook. Following the field-test and resultant refinement of passages and items, the multiple-choice cloze testing system

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*A more complete description of the construction of the test is available on request from the Bureau of School and Cultural Research. (See address at bottom of page 33.)

FIGURE 3

Sample Literal Comprehension, Main Idea and Detail

A lone swordsman was quietly eating his dinner in a small Japanese inn. He appeared calm, not bothered by the four flies buzzing around him. Three ronin (samurai unattached to any of the great feudal clans) entered. They noticed the magnificent swords in the man's sash, and the old, faded clothes that showed he too was clanless. They knew the swords were worth a small fortune, and they were confident that one man was no match for the three of them.

The three men sat down at the next table and began to make loud comments about their neighbor, hoping to goad him into a duel. He seemed to take no notice and their remarks became ruder and more pointed. The swordsman merely raised his chopsticks; in four quick snips, he effortlessly caught the four flies on the wing. As he slowly laid down the chopsticks, the three ronin hurriedly left the room. They had tried to pick a fight with Miyamoto Musashi, one of the greatest swordsmen in the history of Japan.

1. The best title for this selection is

   A. A Lone Swordsman
   B. A Small Japanese Inn
   C. A Small Fortune
   D. Feudal Clans

2. The main idea of this selection is

   A. The three ronin hurriedly left the room.
   B. The three ronin noticed the magnificent swords in the man's sash.
   C. The three men sat down at the next table and began to make loud comments about their neighbor.
   D. The three ronin had tried to pick a fight with Miyamoto Musashi, one of the greatest swordsmen in the history of Japan.

3. How did the swordsman appear?

   A. calm
   B. confident
   C. bothered
   D. rude

4. What became ruder?

   A. the three men's manners
   B. the three men's remarks
   C. the three men's language
   D. the three men's behavior

5. Who knew the swords were worth a small fortune?

   A. a lone swordsman
   B. Toshiro Mifune
   C. the three ronin
   D. Miyamoto Musashi

6. What had the three ronin tried to do?

   A. kill the swordsman
   B. leave the room
   C. enter the inn
   D. pick a fight

7. When did the three ronin hurriedly leave the room?

   A. before they had finished their dinner
   B. after they had finished their dinner
   C. as the swordsman slowly laid down his chopsticks
   D. when the swordsman slowly drew his long sword

will be used in productivity analyses of reading programs. In addition, the passages and items will be made available to teachers in the form of a Test Development Notebook. The purpose of the Notebook is to provide sufficient numbers of test passages and items at various levels of difficulty so that literal comprehension at a given level may be monitored periodically with the administration of series of comparable test forms. In its final form, the Notebook will be a computerized bank of passages and items from which any number of tests can be constructed at specific levels of difficulty in particular subject areas.

Empirical Investigations to Date

Measuring Program Resources

As noted in the Introduction to this paper, considerable research effort has been committed to the measurement of student achievement in reading comprehension since the Coleman Report. More specific and useful conceptions of comprehension have resulted from that concerted effort. In addition, theorists like Carroll have helped make important distinctions between general tests of verbal ability on the one hand and tests of comprehension *per se* on the other. Out of these research efforts and conceptual distinctions have come the first tentative tests of student achievement in literal comprehension.

But the development of accurate measures of reading comprehension, though a difficult and important research goal for the bureau, is not an end in itself. What school districts need is a practical and economical system for analyzing productivity in reading programs. The ultimate goal, then, is not only to measure achievement in reading comprehension accurately but to help school districts *increase student achievement without raising costs*. Before the new achievement tests can be used to study productivity in reading programs, however, researchers must solve the vexing problem of measuring program resources accurately.

Not only is there a bewildering array of program variables to measure (e.g., teacher age, sex, degree status; whole-group, individualized, paid-aide instruction; student body characteristics; facilities), but the complexity of the measurement problem is further confounded by the need to quantify the actual *use* rather than the mere availability of program resources. In his study of Title I programs, Cohen indicated the need to study the use rather than the availability of resources. He found, for instance, that there is at least as much if not more variation between classrooms in the way resources are used as there is between different programs.[50] Measures of program resources, therefore, must be accurate enough to reflect the variations in the use of resources between classrooms. Moreover, in order to analyze the impact of resource utilization on student achievement, precise measures of resource allocation must be directly related to individual students within the classroom.

Productivity studies and related research have generally avoided these practical problems by using levels of analysis well above the individual student. However, researchers have identified a viable unit of measurement for program resources.

Garner has recently suggested that "to measure the actual utilization of the various resources means no more than to measure the time in which they are employed in various ways. In a fundamental sense, allocation of resources (human or material) is allocation of time."[51] If the problem is accurate measurement, time is a variable of central importance in studies of school resources, for

> Time can be measured with as much precision as the researcher desires. The measures of time have properties that are almost impossible to secure in our conventional measures of academic achievement: equality of units, an absolute zero, and clear and unambiguous comparisons of individuals. Furthermore, time as a variable can be put into economic and resource costs for the individual learner, for groups of learners, and for schools and communities.[52]

Over the last decade, researchers have developed several improved mathematical models of school learning which allow for the conceptualization of a very complex process in terms that are eminently quantifiable. Carroll's model,[53] for instance, relates the time a student needs to learn a task to the time actually spent learning the task:

---

[50] David K. Cohen, "Politics and Research: Evaluation of Social Action Programs in Education," Review of Educational Research, 40 (April, 1970), pp. 213-238.

[51] William Garner, "Inputs and Outputs in the Educational Process" (ED-075-948), a paper given before the American Educational Research Association Annual Meeting in New York (February 2-7, 1971), p. 6.

[52] B.S. Bloom, "Time and Learning," American Psychologist, 29 (September, 1974), pp. 683-684.

$$\text{Degree of Learning} = f\left(\frac{\text{time actually spent}}{\text{time needed}}\right)$$

In an elaboration of Carroll's model, Wiley and Harnischfeger noted that "achievement ... is directly determined by only two variables: total time needed by a pupil to learn a task ... and total time a pupil actually spends on a given task."[54] The model, as expanded by Wiley and Harnischfeger, becomes

$$\text{Achievement} = f\left(\frac{WXY}{Z}\right)$$

where

> W is the total Allocated Exposure Time,
>
> X is the percent Active Learning Time, ...
>
> Y is the percent Usable Exposure Time, [and]
>
> Z is the total Needed Learning Time.[55]

The parsimony of this equation is attractive. The practicality and utility of the symbolic conversion of student and program characteristics into time factors, however, must be verified empirically. The real complexity of school learning behind the Wiley-Harnischfeger equation is indicated by the conceptual model in FIGURE 4. When such a generalized model is applied to

---

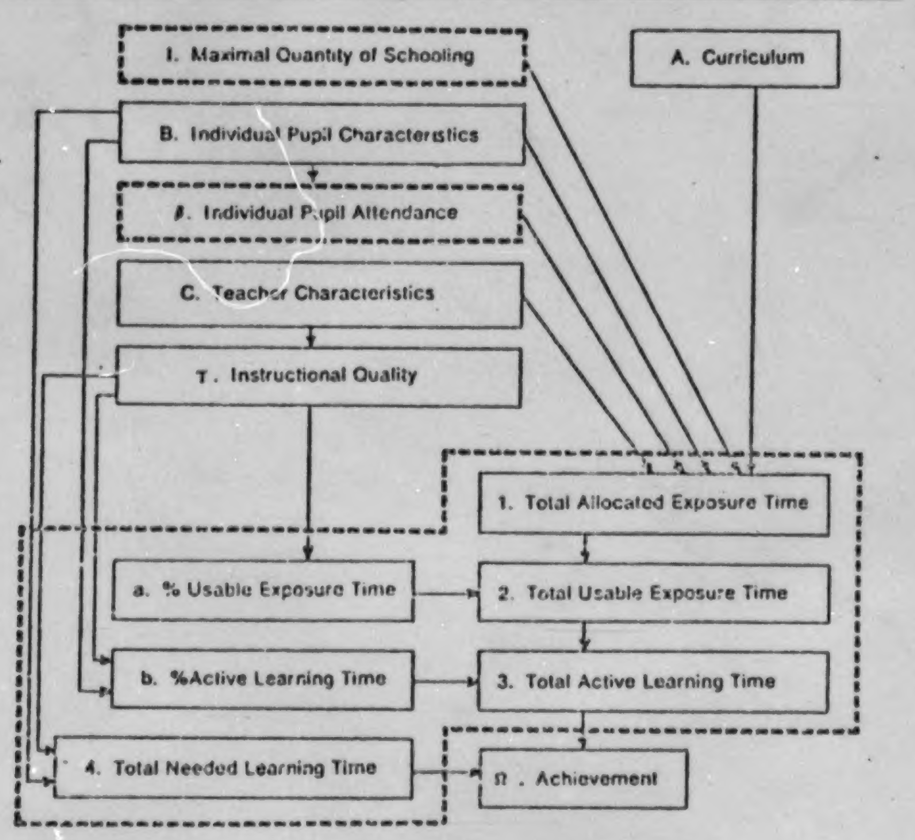
[53] John B. Carroll, "A Model of School Learning," Teachers College Record, 64 (1963), pp. 723-733; "Problems of Measurement Related to the Concept of Learning for Mastery," Educational Horizons, 48 (1970), pp. 71-80; and Fitting a Model of School Learning to Aptitude and Achievement Data Over Grade Levels (RB-73-51) (Princeton, N.J.: Educational Testing Service, 1973).

[54] Wiley and Harnischfeger, op. cit., p. 11.

[55] Ibid., p. 11.

FIGURE 4

Individual Instructional Exposure and Achievement[56]


I. Maximal Quantity of Schooling
A. Curriculum
B. Individual Pupil Characteristics
β. Individual Pupil Attendance
C. Teacher Characteristics
T. Instructional Quality
1. Total Allocated Exposure Time
a. % Usable Exposure Time
2. Total Usable Exposure Time
b. %Active Learning Time
3. Total Active Learning Time
4. Total Needed Learning Time
Ω. Achievement

---

[56] *Ibid.*, p. 10.

the complexities of a particular instructional program, however, the investigator has to measure the actual minutes per week that an individual student is exposed to every instructional mode within the program (e.g., whole-group, individualized, and paid-aide instruction). The pilot study reported below incorporated both conventional measures of resources and time as measures of resource utilization.

A Pilot Study of Productivity in Reading Programs

The Bureau conducted preliminary research on the feasibility of a productivity analysis of reading programs in 1974-75. An exploratory study was designed to develop and validate a practical and economical method for analyzing reading programs at the local level. The major research questions, in light of the previous discussion of achievement tests and the measurement of program resources, were framed as follows:

1. Is a criterion-referenced test of reading comprehension more sensitive to variations in the allocation of program resources than a standardized, norm-referenced test?
2. Do educational production functions (the formal statement of educational input-output relationships) differ for school districts?

The preliminary analysis was based on a sample of 3047 students in grades 4, 5, and 6 in four school districts. These school districts, identified as A, B, C, and D in TABLE 4, were roughly comparable in student socio-

TABLE 4

Characteristics of School Districts

Variables	District			
	A	B	C	D
District Type	Suburban	Urban	Urban	Urban
% White	89	83	42	63
% Lower Income	25	36	59	37
No. Pupils	567	947	1010	523
No. Schools	2	7	5	3
No. Teachers	36	56	60	25

economic status. District A, however, had higher percentages of upper income families and white students in each class, while District D had lower percentages of upper income families and white students in each class.

These particular school districts were selected because they varied in the way they used program resources to teach reading. District A, for example, had a modest investment in added resources for reading instruction, primarily in reading centers run by specialists who performed a coordinating function. The other three districts had more extensive investments in compensatory reading programs which were primarily independent adjuncts to the regular programs.

Since the focus of the study was the individual student, it was necessary to quantify factors that might affect a student's achievement in reading. As a consequence, the Bureau gathered data on more than 70 school and program variables in each district. (The Technical Appendix* contains a complete list of all the variables on which data were gathered.) Following a complete data edit, data with low reliability were eliminated. A list of the 38 variables included in the main analysis reported in this paper is given in TABLE 5.

A unique element of this research project was the estimation of instructional time actually allocated to individual students within classrooms and in adjunct compensatory treatments. The Bureau demonstrated that it is possible to gather reliable data on instructional time for large numbers of individual students efficiently and economically. Data on the quantity of

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*The Technical Appendix to this report is available on request from the State Education Department. Division of Research, Bureau of School and Cultural Research, Albany, New York 12234.

TABLE 5

Variables Included in the Main Analysis

Variable Number	Variable Name
1	Student's age
2	Father's occupation[a]
3	PEP[b] raw score in 3rd grade
4	No. of pupils in reading class
5	Teacher's degree status
6	IMRU (Index of materials resource utilization)
7	Post CAT[c] Total Reading
8	Effect for school 1[d]
9	Effect for school 2
10	Effect for school 3
11	Effect for school 4
12	Effect for school 5
13	Effect for school 6
14	Teacher's age
15	% white in class
16	% working poor
17	% unskilled
18	% skilled blue collar
19	% skilled white collar
20	% business
21	% professional
22	Minutes per year (mpy) whole-group teacher instruction[e]
23	Mpy small-group teacher instruction
24	Mpy individual help by teacher
25	Mpy individualized instruction, teacher
26	Mpy small-group instruction
27	Mpy individual help
28	Mpy individualized instruction
29	Mpy total teacher instruction
30	Mpy specialist instruction
31	Mpy paid-aide instruction
32	Mpy unpaid-aide instruction
33	Pre-CAT Total Reading
34	Pre-CAT by whole-group instruction[f]
35	Pre-74 CAT by small-group instruction
36	Pre-CAT by individual help
37	Pre-CAT by individualized instruction
38	Classroom Socioeconomic Status Index

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[a] Eventually deleted and replaced with variable number 38, Classroom Socioeconomic Status Index.

[b] Pupil Evaluation Program: standardized, norm-referenced reading and math tests developed by the New York State Education Department. These tests are administered in grades three and six. Only grade three tests are used in this report.

[c] California Achievement Test (1970 norms): another standardized, norm-referenced test. As many as three levels and two forms of this test were used.

[d] This is simply an overall control variable representing the gross effect of each school within a district.

[e] All time variables were natural log transformations of minutes per year.

[f] All interactions involved variables in standard z-score form.

reading instruction were gathered using taped interviews with principals, teachers, specialists, and selected teacher aides. (The Technical Appendix contains the interview schedules and instructions.) The teacher and specialist interviews resulted in estimates of the actual minutes per week per student of reading instruction in each of four instructional modes: whole-group, small-group, individualized, and individual help. These multiple interviews verified the actual time allocated to each student for reading instruction in each of the four modes. Time estimates in these modes were also obtained for additional instructional time by paid and unpaid aides. The minutes per week per student were converted into minutes per year, resulting in a more accurate measure of resource allocation by accounting for student absences.

In addition to instructional time estimates, the interviews provided a record of all materials and equipment used as resources in teaching reading. An index of materials resource utilization (IMRU) was developed to quantify simultaneously the type of instructional resources used by a teacher and the extent of this utilization. The interview schedule grouped instructional resources into the following categories: (1) basal series, workbooks, and other skill-builder supplements; (2) additional software; (3) hardware (equipment); and (4) teacher-created materials. To obtain an IMRU for each teacher, a total score for all categories was based upon the number of materials used in each category and how they were used. Materials used as a major resource were given a value twice that given supplemental materials like "additional workbooks." The final IMRU was thus the sum of the scores for each category of materials.

In this experimental study, the analysis differs substantially from the approach suggested by Wiley and Harnischfeger in that there was no attempt made to convert all school and program variables into time factors. Instead, all input variables were analyzed independently and simultaneously. This independent and simultaneous analysis resulted in a much simpler conceptual model as indicated in FIGURE 5.

In accord with the major categories of the conceptual model, additional research questions were framed as follows:

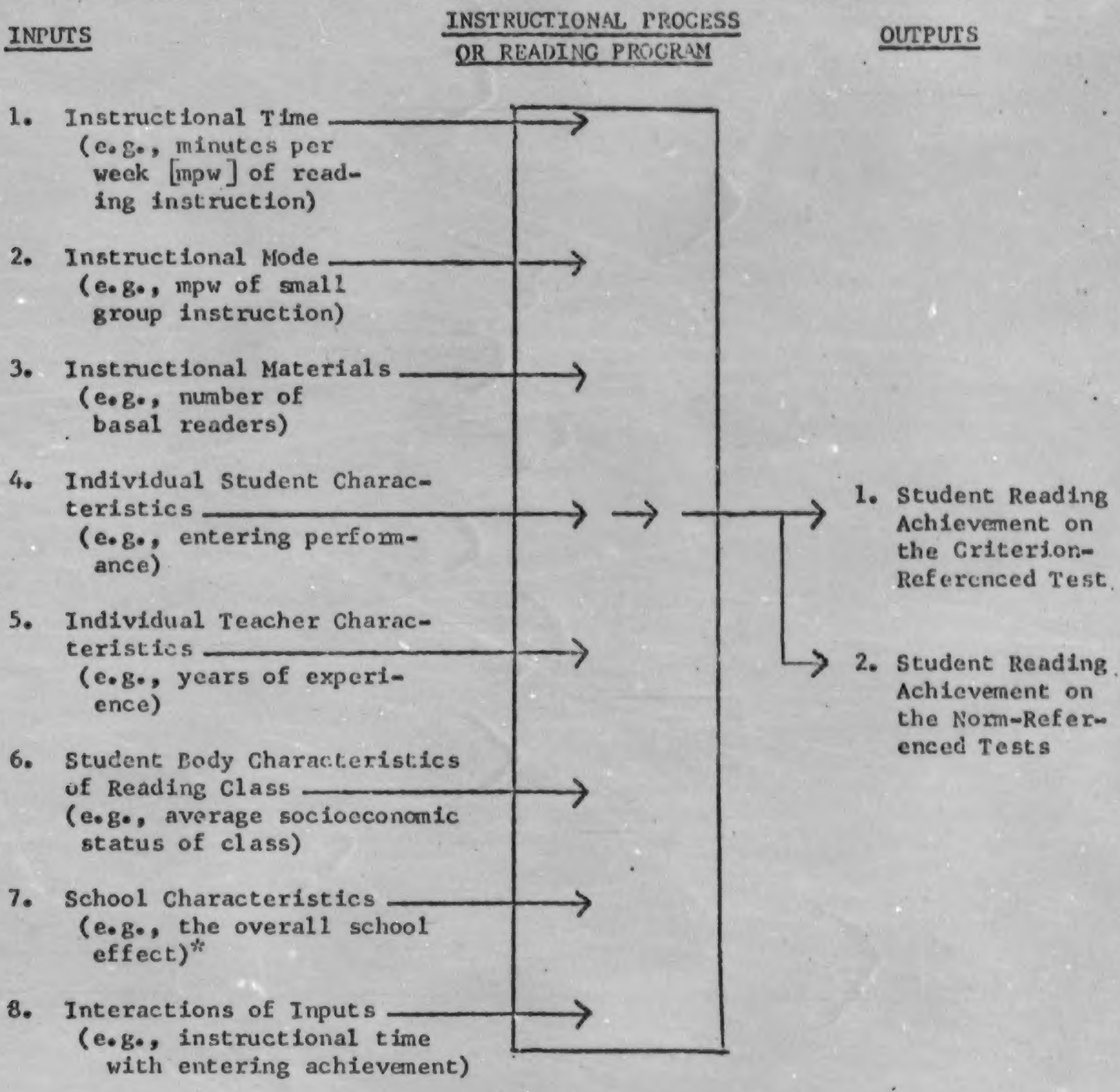
1. Does the amount of time allocated to reading instruction affect reading achievement?
2. Does the amount of time allocated to different instructional modes (whole-group, small-group, individualized, individual help) affect reading achievement?
3. Does the availability of instructional materials affect reading achievement?
4. Does student ability as measured by norm-referenced tests affect reading achievement?
5. Does teacher quality (e.g., experience, preparation time, training) affect reading achievement?
6. Does the number of students in the reading class affect reading achievement?
7. Do individual school characteristics affect reading achievement?
8. Does the affect of instructional time on reading achievement vary as a function of student ability.

As indicated in the conceptual model in FIGURE 5, the allocation of program resources was compared to test scores on both criterion- and norm-referenced tests. The California Achievement Test (CAT) and the Pupil Evaluation Program (PEP), developed by the New York State Education Department, represented standardized, norm-referenced tests in the pilot study. Raw scores for previous reading ability were used from the PEP. Achievement Development Scale Scores (ADSS) from the CAT were especially useful because they had interval scaling and normal distributions. In addition, the ADSS were independent of form, level, grade, time of administration, and restandardization.

The bureau developed the criterion-referenced test especially for the

FIGURE 5

Simplified Conceptual Model of a Reading Program


INPUTS
INSTRUCTIONAL PROCESS OR READING PROGRAM
OUTPUTS
1. Instructional Time (e.g., minutes per week [mpw] of reading instruction)
2. Instructional Mode (e.g., mpw of small group instruction)
3. Instructional Materials (e.g., number of basal readers)
4. Individual Student Characteristics (e.g., entering performance)
5. Individual Teacher Characteristics (e.g., years of experience)
6. Student Body Characteristics of Reading Class (e.g., average socioeconomic status of class)
7. School Characteristics (e.g., the overall school effect)*
8. Interactions of Inputs (e.g., instructional time with entering achievement)
1. Student Reading Achievement on the Criterion-Referenced Test
2. Student Reading Achievement on the Norm-Referenced Tests

*These are control variables representing the effect of a particular school within a district.

pilot study. Committees of teachers and reading specialists in each of the nine participating school districts selected from the Bank of Reading Objectives[*] those objectives in the areas of vocabulary and comprehension that seemed most pertinent to their own reading programs. Lists of basic sight words and of graded reading materials supplied by the school districts were used as a guide in the selection of passages and vocabulary items.

Grades 4 through 6 had been selected for study. Criterion-referenced tests, however, must be geared to the level at which students are actually achieving, irrespective of their grade placement. Since the range of achievement was approximately seven years for these three grades, seven levels of the test, correponding roughly to grades 1 through 7, were constructed

The longitudinal design of the study called for repeated criterion-referenced measurement on the same students at regular intervals. All school districts administered the criterion-referenced tests five times at 2-week intervals between March and June of 1974 as indicated in TABLE 6. Five equiva-

TABLE 6

Design for Data Collection

Data Instruments	Pre-1973	May 1973	February 1974	March 1974	April 1974	May 1974	June 1974
PEP	x						
CAT		x[a]	x				x
CRT				x	xx	xx	
Reading Program Data Gathered via Interviews and School Records				x	x	x	x

[a] These data on the CAT were available for a sub-sample of students.

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[*] Compiled by the Bureau, the Bank contains some 2000 objectives organized into six areas: Multisensory Readiness, Decoding, Vocabulary, Comprehension, Location and Study Skills, and Reading in the Content Areas. In the pilot study, items were restricted to two areas--vocabulary and comprehension.

lent forms of the test were constructed at each level, and students were assigned in random order to the various forms in such a fashion that ultimately every student took all five forms of the test at the level to which he had been assigned by his teacher.

Analytical Procedures

The analytical procedures were designed to provide evidence about the research questions. The procedures included data editing, reducing the number of variables, and deriving the parameters of the reading programs. Following the data edit, frequency distributions were obtained for all variables. (When there were gross amounts--15% to 20%--of data missing for a variable, it was eliminated.) The relatively skewed distributions led to the conversion of all time variables into natural logarithms. Means, standard deviations, and correlations were than calculated. Data with low variability were eliminated.

A principal components analysis with varimax rotation was then completed on a large proportion of the raw data matrix, including multiplicative interactions of instructional time and quality variables. The results from this factor analysis led to a reduction in the number of original variables and to the conclusion that student aptitude was interacting with instructional time. Therefore, in subsequent analyses, each students' third grade PEP scores and midyear CAT scores were used as statistical controls on ability. The dependent variable was either the CRT or the norm-referenced June CAT. Variables for the interaction of instructional time with student aptitude were included in some of the analyses, but these analyses are only reported in the Technical Appendix.

With the number of variables reduced to a manageable set, a series of production functions was developed. The research questions focused on estimating the relationship between the input and output variables listed in FIGURE 5. A production function is a formal statement of these input-output relationships and can be expressed symbolically as

$$Y = f(x_1, x_2, x_3)$$

where

$Y =$ student performance on a CRT or NRT,

$X_1 =$ instructional time,

$X_2 =$ instructional materials,

$X_3 =$ teacher degree status.

In this case, final student performance is a linear function of time, materials, and teacher qualifications. In the case of interacting inputs, the least complex relationship could be expressed as $Y = f(x_1 x_3)$ where final student performance is a function of instructional time multiplied by teacher degree status. The form of this relationship may be such that a student's performance will improve with more instructional time by a more highly trained teacher.

The importance of the program inputs in determining student achievement was arrived at analytically through multiple regression analysis. A more formal account illustrates the procedures used. Beginning with the input variables as predictors--that is, X_1, X_2 ... X_n--and a criterion variable, Y, the procedure assumes a linear model of the general form,

$$Y = b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots\, b_n X_n + c$$

where Y is the performance measure predicted on the basis of the "n" predictors weighted by the numbers $b_1 \ldots\ldots b_n$ plus an additive constant "c." The b-weights are raw regression coefficients. The "sign" (i.e., + or -) and magnitude of the b-weights are important. If the effects of the X's (i.e., the inputs) on Y (i.e., student performance) are linear, then a positive sign means a positive relation exists between an input and student achievement. A negative sign usually indicates a negative relationship; for example, if instructional time increased, student performance would decrease. The magnitude of the b-weights can be interpreted as follows: if an input (X) changes one unit, the output (Y) changes "b" units. For example, if b = .50 for X, then as X changes one unit, Y changes half a unit. Usually, the effect of a particular input variable is not interpreted unless its associated b-weight is statistically significant. The statistical significance of the b-weights is determined by reference to the "t" distribution. The direction and magnitude of the input or resource variable in predicting student achievement are summarized in the following section of this paper.

Results*

As indicated in FIGURE 5, a conceptual model was developed as a framework for dealing with the main questions of interest. These questions were:

1. Is a criterion-referenced test of reading comprehension more sensitive to variation in the allocation of program resources than a standardized, norm-referenced test?
2. Do educational production functions (the formal statement of educational input-output relationships) differ for school districts?

As an introduction to differences across districts, TABLE 7 provides the means and standard deviations of the major variables used in subsequent analyses. For ease of reference, variables are listed under the major categories of the conceptual-analytical model. TABLE 7 reflects wide

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*For a detailed mathematical presentation of the findings, refer to the Technical Appendix.

TABLE 7

Means and Standard Deviations of Reading Program Variables within School Districts

Variables	District			
	A (N=567)	B (N=947)	C (N=967)	D (N=523)
Student Characteristics				
CAT Pretest[a]	441.9 (63.1)	430.2 (70.4)	372.8 (68.3)	409.4 (77.8)
CAT Post-test	461.7 (64.2)	440.4 (72.0)	398.5 (74.5)	422.5 (74.8)
PEP Ability[b]	32.9 (10.5)	28.1 (10.2)	NA	30.7 (10.1)
Age (in half years)	21.8 (1.7)	22.2 (2.0)	21.8 (2.2)	21.6 (1.9)
Teacher Characteristics				
Age (in years)	43.5 (9.6)	39.6 (12.1)	31.3 (9.5)	37.2 (9.8)
Degree Status	6.8 (0.8)	6.0 (1.1)	5.9 (1.0)	5.5 (0.7)
Reading Class Structure				
Number of Pupils	31.0 (4.3)	24.6 (4.6)	22.8 (4.6)	25.2 (4.3)
% White	89.0 (8.7)	83.0 (18.2)	41.5 (29.5)	63.9 (32.7)
% Working Poor/Unskilled Worker	25.0 (16.6)	37.2 (32.5)	58.6 (34.6)	38.1 (30.9)
Instructional Materials				
IMRU	9.1 (3.1)	11.3 (4.2)	11.8 (4.3)	10.9 (3.3)
Instructional Time[c]				
MPY Teacher Whole-Group	2443.2(2924.7)	2437.7(3995.6)	3457.9(4597.8)	1076.5(1593.1)
MPY Teacher Small-Group	5600.9(3083.6)	5088.3(3764.3)	7225.6(5529.6)	7878.7(6162.5)
MPY Teacher Individual Help	23.1 (93.7)	86.6 (255.0)	124.4 (749.4)	136.5((290.0)
MPY Teacher Individualized Instruction	NA	327.4(1351.3)	863.5(3452.5)	1067.5(3020.6)
MPY Total Specialist	74.4 (452.7)	698.4(1715.7)	596.1(2224.1)	933.9(2509.2)
MPY Total Paid-Aide		429.5(1470.4)	1087.9(3389.6)	211.2(1083.3)
MPY Total Unpaid-Aide	35.3 (315.1)	33.8 (369.7)	110.7 (637.8)	35.0 (260.3)

Note: Standard deviations are in parentheses.

[a] California Achievement Test--1970 Norms, Scores are Achievement Development Scale Scores.

[b] PEP tests are statewide, norm-referenced tests developed by the State Education Department, Albany, New York.

[c] Instructional time variables are in minutes per year per student.

in the study sample. The teachers' average ages, for instance, varies from district to district. It is encouraging to note that the instructional time variables also reflect considerable diversity. Each district is allocating their reading program resources in unique patterns. These patterns provided the basis for further analyses of the relationship between program resources and student performance. Multiple regression was used to determine the nature of these relationships.

Sensitivity of Student Performance Measures. Two main analyses were completed in order to compare the sensitivity of the norm-referenced test (NRT) to the sensitivity of the criterion-referenced test (CRT).

The first analysis determined the effects of instructional time and student characteristics on the CRT and the norm-referenced California Achievement Test (CAT). The main findings indicated that instructional time was related negatively to both the CRT and the CAT. The occupation of the student's father was positively related to the CAT.

Several characteristics of the first analysis suggested the need for a slightly different approach. These analyses were based on different CRT and NRT student subsamples. In addition, instructional time was measured in minutes per week, and student performance on the CAT was measured in grade equivalent scores. The negative time effects from the first analysis also needed further clarification.

Thus, a second analysis of CRT-NRT differences was initiated. This analysis differed in several ways from the first. Instructional time was estimated more accurately as minutes per year based on minutes per day times the number of days each student actually attended school. The CRT-NRT comparisons were based on identical students, not separate sub-samples. Another major difference was in the number of statistical control variables. These second analyses were very conservative regression models controlling for the following variables: number of pupils, percent white, and socioeconomic composition of the reading class; student's third grade PEP scores in reading, student's age and father's occupation; teacher's age and degree status. The CAT scores were Achievement Development Scale Scores with equal intervals and normal distributions. These multiple regression analyses were designed to clarify the extent to which CRT's and NRT's measure different aspects of student reading performance. The inclusion of the control variables also indicated relative test sensitivity to program resources.

The findings from the second CRT-NRT analysis can be summarized as follows:

1. A greater number of variables defining the instructional environment were related to CRT performance than to NRT performance.
2. Instructional time variables were significantly related to CRT performance more often than NRT performance.
3. Both the criterion-referenced test and the norm-referenced California Achievement Test measure unique aspects of reading comprehension.

The greater sensitivity of the CRT versus the NRT for the instructional time variables must be interpreted cautiously. Many of these time effects have proven to be curvilinear, not linear. (See the Technical Appendix for details.) Detailed studies of these time effects reveal that schools differ in their distribution patterns for instructional time. In essence, lower performing students on the average receive more instructional time. However, student performance does not increase until a considerable amount of instructional time is given to the students. Student performance also varies with staff type (e.g., paid aide).

The findings on test sensitivity provide evidence in support of the use of CRT's over NRT's in studies of educational production functions.

District Production Functions. An educational production function describes mathematically how school inputs (resources) relate to student performance (outputs). In these analyses, inputs included school, teacher, and student characteristics while output was measured by the California Achievement Test (CAT). The norm-referenced CAT was used instead of the CRT due to better reliability, distribution characteristics, and the fact that interval scaled scores could be used within each district.

These production function studies included all of the control variables used in the CRT-NRT comparisons plus a control for school effects. In addition to determining the importance of these variables, the Index of Materials Resource Utilization was studied. These analyses helped determine the relative importance of the explanatory and control variables in predicting student reading performance.

The general findings from the production function studies for each of the four school districts can be summarized as follows:

1. A large proportion of the variance in CAT performance was accounted for in each district;
2. The variables that significantly accounted for CAT variance differed somewhat from district to district. (For example, percent white in the reading class was significant and positive in two of the four districts.)
3. The Index of Materials Resource Utilization was not significantly related to CAT performance.
4. Instructional time variables were significant in three of the four districts. (In one district, four out of eight time variables were significantly related to student performance.)
5. The importance of different teaching staff changed from district to district. (For example, the teacher effect was significant and positive in one district. However, the effects due to reading

> specialists and paid aides were negative in three districts and usually curvilinear. These curvilinear effects for specialist's time mean that lower performing students receive more instructional time and that student performance does not go up until rather high levels of instructional time are reached. However, it cannot be concluded that these specialist effects would occur without regular classroom instruction. The latter condition did not occur in the study.)

The production function studies support the use of time as a measure of resource utilization in the schools. This fact combined with the greater sensitivity of CRT's over NRT's produced a foundation for more legitimate productivity studies. Future productivity studies will measure program resources in units of time and program outputs with criterion-referenced tests scaled as precisely as time.

Conclusions and Projected Research

The halcyon days of educational funding seem to be gone forever. Public schools are harried by fiscal cutbacks and face a future of continuing budgetary strictures. Ironically, while funds shrink, there is a growing demand--public and professional--for increased quality in school programs, especially in critical skill areas like reading. Talk of education accountability, of value received for dollars spent, and of input-output relationships has grown steadily in volume in the last 10 years. In competition for limited funds, school programs are being forced to prove their value. And they are expected to show improvement in student achievement irrespective of funding. The critical problem facing school districts, then, is how to increase student achievement without raising costs.

The work of the Bureau of School and Cultural Research reported in this paper addresses this critical problem in two ways: (1) by investigating evaluation in reading and attempting to design a more appropriate and efficient testing system, and (2) by studying the feasibility of productivity analyses of reading programs.

As mentioned in the Introduction to this paper, considerable research effort has been committed to the measurement of student achievement in reading since the Coleman Report, but that effort has generated controversy as well as new concepts and tests. Proponents of norm- and criterion-referenced tests fire critical volleys at each other in the professional journals. Though the new criterion-referenced tests have not replaced traditional, norm-referenced tests, two points have clearly emerged from the critical debate: (1) because norm-referenced tests are, in effect, designed to be insensitive to instruction and because their scaling properties make it difficult to interpret or compare scores, norm-referenced tests are not useful for evaluating reading programs; and (2) the global measures of "reading comprehension" that characterize norm-referenced tests no longer satisfy the evaluative needs of school districts which are moving toward individualized instruction and mastery learning.

In light of these considerations, the bureau set out to compare the sensitivity of a criterion-referenced test of reading comprehension with that of a norm-referenced test of reading and to study the feasibility of productivity analyses of reading programs by comparing the results of both tests to variations in the allocation of program resources. The findings of a pilot study conducted in the spring of 1974 indicated clearly that the criterion-referenced test was more sensitive to the use of program resources than the norm-referenced test.

The bureau was encouraged by the sensitivity of the rudimentary, criterion-referenced test used in the pilot study, but the inadequacies of the test were just as obvious. Like traditional, norm-referenced tests, the experimental, criterion-referenced test attempted to assess a wide spectrum of cognitive skills. Though the items were clearly identified in relation to particular course objectives, each test form contained only a few items on any one objective. Furthermore, neither the passages nor the items were accurately scaled for levels of difficulty. Finally, the test was not sufficiently objective in construction to allow for the economical production of large volumes of items for a great number of parallel test forms.

The bureau decided to develop an accurate, useful, and economical test of comprehension per se. An attempt was made to disentangle literal comprehension--the act or process of grasping the explicit, societally standardized meaning of a verbal message--from more sophisticated, inferential processes that school systems hardly seem to affect. Literal comprehension, as defined above, is very close to popular notions like "basic literacy" and can be referenced directly to whatever verbal messages school districts decide their students ought to be able to comprehend. The bureau's conceptualization of literal comprehension, then, is not only academically useful, for it is fundamental to any further derivation of meaning from a verbal message, but it is also socially useful. The public, for instance, expects high school graduates to be "literate," to be able to derive explicit, societally standardized meanings from reading materials like newspapers, consumer directions, or job application forms.

To test literal comprehension accurately and economically across a wide array of reading materials, the bureau developed a multiple-choice cloze testing system rather than a test as such. The testing system is composed of a pool of graded, "clozed" passages with sets of alternate responses for each deletion. Tests can be assembled from this pool in a variety of ways to suit particular evaluative needs. The procedures used to grade and "cloze" the passages and select alternate responses were made systematic enough to be reproducible. (The objectivity of item construction is indicated by the fact that the selection of alternate responses has already been computerized.) To date, nearly 1500 passages have been sampled from a variety of reading materials in specified domains, graded for difficulty, and "clozed." Nearly 15,000 sets of alternate responses have been written and reviewed.

Validation and refinement of the testing system began in the spring of 1975 and will continue through the 1975-76 academic year. In the course of the validation, the passages will be calibrated accurately for difficulty on a scale with equal intervals and a meaningful zero point using a modified Rasch procedure. (Such a scale is a prerequisite to the production of comparable test forms or legitimate productivity analyses.) Eventually, the graded and "clozed" passages and sets of alternatives will be stored on computer tapes. Teachers will then be able to request tailor-made test forms--sampled from specific kinds of reading materials at specific levels of difficulty--and the test will be assembled entirely by machine.

The accurate, economical assessment of student achievement, however, is only part of a productivity analysis of reading programs. It is equally important to measure the allocation of program resources on a comparable scale. In the pilot study of the feasibility of productivity analyses of reading programs conducted in the spring of 1974, the bureau demonstrated that it is possible to gather large quantities of data on the allocation of instructional time in the classroom and in compensatory programs. Measuring resource allocation in units of time is important because costs can then be expressed in terms of unit costs (i.e., dollars per hour per student). A cost-time ratio is a precise, common scale on which all programs can be compared to determine relative differences in expenditures. Moreover, the measurement of program resources in units of time results in a scale with equal intervals and a meaningful zero point which can be compared to the measure of student achievement outlined above. Legitimate productivity analyses thus become possible.

Following the validation of the multiple-choice cloze testing system and the calibration of the passages, the testing system will be ready for use in a general demonstration of the analytical approach to productivity in reading programs. A statewide survey of productivity in reading programs is proposed. A proportionate sample of classrooms in grades 1, 3, 6, 9, and 12 will be drawn from a representative set of 200 school districts in the State of New York. The survey sample will number about 10,000 students and will allow for generalization of results by region and for the whole state.

This survey will assess the amount of instructional time actually allocated to individual students in the regular classrooms and in any adjunct or compensatory programs. In addition to the allocated time, the effective learning time for each student will be estimated. Cost data associated with staff, facilities, equipment, and instructional materials will also be gathered. Further, the design of the survey will make it possible to assess organizational features of programs and emphasis on particular objectives.

The overall intent of this component of the survey is to assess the contribution of the quantity and quality of instruction to achievement in literal comprehension. In another component of the survey, the impact of reading time and materials in the home on achievement in literal comprehension will be assessed. The focus on reading in the home would be relevant to the formulation of policy about parent- or community-oriented programs designed to improve reading performance. It may well be that careful investments in the family or community context will be more productive in improving reading performance than some compensatory treatments applied in the school.

Overall, the survey may have a number of policy-relevant findings. Representative statewide estimates of levels of literacy in particular domains of reading materials will be available for the first time. For example, the survey will attempt to answer questions like the following: Can 12th grade students comprehend the written messages on the front pages of newspapers? Of equal importance will be data describing how the amount of time spent on reading varies in school programs and in homes. Aside from this useful descriptive data, the results of the survey will yield important findings on the effect of various instructional variables on reading achievement. It is expected that these results will make important contributions in the formulation of policy concerning the most productive uses of funds for reading instruction in New York State.

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MEASUREMENT AND PRODUCTIVITY
IN SCHOOL READING PROGRAMS

TECHNICAL APPENDIX

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1.0 Introduction

This Technical Appendix to "Measurement and Productivity in School Reading Programs--Main Report" provides a detailed summary of procedures, results, and survey instruments.[a] The Appendix is written for the research specialist interested in the Main Report's conclusions. It is designed to clarify procedures and results and to present studies which will help reduce disagreement over some of the research approaches employed.

The Technical Appendix not only supplies supporting evidence for the Main Report, but also contains a supplemental study, entitled "Effect of Comprehensive Achievement Monitoring on Student Learning." This study is related to the Main Report because it deals with the effectiveness of a similar criterion-referenced testing system. In the Main Report, the criterion-referenced testing component of the research design was embedded in a longitudinal design using the California Achievement Test (CAT). The Main Report compares norm- and criterion-referenced tests; this related study analyzes the same criterion-referenced testing system over a three year period with comparisons with the Metropolitan Achievement Test, another norm-referenced test. It is encouraging that this report concluded that criterion-referenced tests are more sensitive indicators of student achievement than norm-referenced tests. The author noted that "If educational decision makers want evaluation data on the effectiveness of their locally developed curricula, they are more likely to detect program strengths and weakness employing criterion-referenced measures than standardized norm-referenced tests." (p.25) This intact study supports the conclusions of the Main Report.

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[a] This Technical Appendix was written by Steven J. Kidder and Ronald E. Streeter.

2.0 Methodology

Sample. The original student sample consisted of 5887 students in 4th, 5th, and 6th grades in 19 school districts. The individual student was the unit of analysis. Study samples were selected from the original sample for detailed investigations. For example, the number of students in the criterion-referenced analyses varied from 153 to 441. In contrast, the number of students in the norm-referenced analyses went as high as 2231.

The district-by-district sample characteristics are provided in Table 2.1. A fifth district was left out of these studies due to extreme scores and few students. The districts were chosen for wide variation in resources used in reading instruction and variation in socio-economic composition. All of the 4th, 5th, and 6th grade teachers in each school were sampled. These teachers had volunteered to participate in the study and in the installation of an experimental criterion-referenced testing system.

Table 2.1

Sample Characteristics for Each District in the Analyses (N=3004)

Variables	District			
	A	B	C	D
No. Pupils	567	947	967	523
No. Schools	2	7	5	3
No. Teachers	36	56	60	25
Type District	Suburban	Urban	Urban	Urban
% White in class	89%	83%	12%	63%
% Lower Status in class	25%	36%	59%	37%

Research design. The basic research design for the study is presented in Table 2.2. The longitudinal aspect of the design is evident in the repeated data collection points beginning before 1974. Final data collection

Table 2.2

Design for Data Collection

	May 1973	Pre-1974	February 1974	March 1974	April 1974	May 1974	June 1974
Test Administration:							
PEP[a] Test		X					
CAT[b]	X[d]		X				X
CRT[c]				X	XX	XX	
Reading Program Data Gathered via Interviews and School Records				X	X	X	X

---

[a] Pupil Evaluation Program (PEP) norm-referenced tests of reading and mathematics developed at the New York State Education Department. These tests are administered in grades 3 and 6.

[b] California Achievement Test (CAT). Note that up to 3 levels and 2 forms of the CAT were used in the schools.

[c] Criterion-Referenced Test (CRT). Note that up to 8 difficulty levels and 5 forms within each level were available to the schools for testing with this experimental device.

[d] These data are available on a sub-sample of the total sample.

points occurred in June, 1974. The earliest collection occurred when each student was in third grade. The first data point was based on the Pupil Evaluation Program (PEP) norm-referenced test in reading developed by the Bureau of Pupil Testing and Advisory Services at the State Education Department, Albany, New York.

In May, 1973, a sub-sample of about 1600 students received the California Achievement Test (CAT). In January, 1974, and June, 1974, approximately 2500 students received the CAT. Of these students, 1600 had also received the CAT in May, 1973. Therefore, with regard to norm-referenced measures on all students, the final analyses varied somewhat but usually involved the use of the June, 1974, CAT as the dependent variable with the 3rd grade PEP test and the January, 1974, CAT test as statistical controls for prior student performance.

The development and implementation of the criterion-referenced testing component of the design were as follows. In the development phase a Bank of Reading Objectives (BRO), consisting of some 2000 objectives grouped into six areas (multi-sensory readiness, decoding, vocabulary, comprehension, location and study skills, reading in the content areas), was compiled by a team of reading research and curriculum experts. To date, efforts have been concentrated in two of these areas, vocabulary and comprehension. From the objectives for vocabulary and comprehension, each of the nine cooperating school districts selected those which were most relevant to its reading program, determined the grade level or levels at which each objective should be taught and tested, and indicated the relative importance of each objective by designating the number of test items to be constructed per objective. The complete test was designed to be administered in a period of 30 minutes. In order to allow for continuous monitoring (a major goal of the project), five equivalent forms of each test were constructed, and administered at intervals of two and three weeks between March and June, 1974. Subjects were randomly assigned to the five forms of the test. Initially, the study focussed on grades 4 through 6, but since the range of achievement within these three grades was considerably greater than three years, tests were constructed at seven levels, corresponding roughly to grades 1 through 7, each student being assigned by his teacher to the level at which he was achieving.

A data-processing system was used to complement the testing program. The feedback provided to the schools included group data on each item, each objective, and total scores at each level. In addition, every student received information on his own performance on the same measures. The total system, which is known as Comprehension Achievement Monitoring (CAM), has several advantages: (1) it permits diagnostic evaluation of individual and group strengths and weaknesses on specific skills, thus enabling the teacher to deploy instruction time more effectively; (2) it allows for the continuous monitoring of every student on each skill, and is therefore a useful tool in the individualization of instruction; (3) it facilitates flexible ad hoc grouping for the teaching of specific skills on which identified students need further tutoring; (4) as additional data are gathered, correlational studies should indicate empirically which of the skills are indeed most important to the criterion of reading comprehension. CAM is evaluated in the study by Adams in Section 10.0.

The repeated criterion-referenced testing of student reading performance during the spring of 1974 included a form of longitudinal matrix sampling. This testing procedure involved the random assignment of a set of five parallel test forms to any given student using 5 x 5 Latin Squares such that an even and representative distribution of students per form per class was obtained. These five parallel tests were used in each of 6 to 8 levels for grades 4 through 6. Thus, up to eight sets of test forms were provided to a district incorporating the range of reading levels in grades four, five, and six. Typically, a district used 3 levels and 15 test forms to monitor reading comprehension.

During the testing schedule, large quantities of student test data were generated. For example, within the entire study, 3500 to 4000 students took five criterion-referenced tests and two norm-referenced tests. Thus, over 25,000 test forms had to be processed. The data monitoring and processing system used for handling the CRT data was the CAM system. The California Achievement Tests were machine processed and merged (by student) with the CRT and program resources data.

The norm-referenced measure of reading performance was the the California Achievement Test--1970 norms. Raw, grade equivalent, and achievement development scale scores (ADSS) for vocabulary and comprehension were available for each student on both pre-and post-instructional administrations of the test. The ADSS were especially useful because of the following features: interval scaling, normal distribution, and independence of form, level, grade, time of year, and restandardization. Thus, the ADSS can be added, subtracted, and averaged regardless of the level or form of the CAT administered.

The data needed to specifically characterize each reading program were gathered via interviews with teachers, specialists, aides, and principals and searches of school records. This occured form March, 1974, to June, 1974. During the initial interviewing, the schedules were improved. This resulted in the acquisition of quite detailed instructional time data on each particular student. As noted, all of the detailed program data were referenced directly to the individual student. This guaranteed using the student as the unit of analysis within a school. Therefore, most of the analyses are based on variations of individual student scores about average scores for students in each district.

Interview schedules were developed for principals, specialists, and teachers (See Section 11.0). These schedules were designed for gathering as much information as possible on resource allocation and program configuration in reading. Each schedule required approximately sixty minutes for administration. The principal's schedule included school-level questions on student-body SES, reading level, ethnicity plus detailed questions on facilities and special reading programs. The specialist's schedule requested detailed information on program materials, mode of instruction, and the time each specialist or aide spent with each student. The teacher schedule focused heavily on the classroom reading program, teacher characteristics, and student body characteristics. The hardware and software used for reading instruction was listed. Of special interest was the tabulation for each student of the actual number of minutes spent in reading instruction with teachers or specialists, or tutors in the following modes: (1) whole class instruction, (2) small group instruction, (3) individual help (on a one-to-one basis), and (4) individualized instruction (i.e., a "mini-curriculum" per student, individually or in groups).

In an effort to combine all of the instructional material variables present in any given reading program, the Index of Materials Resource Utilization (IMRU) was developed. The IMRU is based upon the type and amount of materials used in a reading program in a specific teachers' classroom and whether they were used as a major or supplemental resource.

The instructional materials variables were grouped into four categories, one for each type of material used: 1) basal series, workbooks, and other skill builder supplements, 2) additional software, 3) hardware, and 4) teacher-created materials. A score for each category was determined; this score was based upon the number of materials used in that category and how they were used. In most cases, materials used as a major resource were given a value twice that given materials used to supplement reading instruction. The IMRU was determined by taking the sum of the four scores derived for each category of materials. A brief description of each of the four scores making up the IMRU follows:

> Materials Category #1. This score for basal series, workbooks, and other skill builder supplements was perhaps the most complex. For each basal series used, a value of 2 was added. A value of 1 was added for each workbook used in conjunction with a basal series. In addition, a value of 1 was added if one to three additional skill builder supplements were used, and a value of 2 if more than three of these skill builder supplements were used. The highest possible score allowed for Materials Category # 1 was 12.
>
> Materials Category #2. Additional software was grouped according to the number of obviously different resources used: less than 3, 3-6, and greater than 6. Values of 1, 2, and 3 were assigned, respectively, when each group of different resources was used as supplemental resources. These values were doubled for gorups used as major resources. If more than six major resources of software and more than six supplemental resources were used, a total maximum of 9 was assigned.
>
> Materials Category #3. In general there were nine different types of hardware used. A value of 2 was assigned to each type of hardware used as a major resource, while 1 was assigned to each type of hardware used as a supplemental resource. The highest possible score, the case in which all nine types of hardware used as major resources, was 18.
>
> Materials Category #4. The score for teacher-created materials is similar to that of hardware. Values of 2 and 1 were assigned to each type of teacher-created material used, depending on whether it was a major or supplemental resource, respectively. Since there were five types, the highest possible score was 10.

As mentioned, the IMRU was the sum of these four scores. The highest possible score that could have been assigned to a particular teacher was 49. This would represent a comprehensive use of resources and materials by a teacher.

This research strategy provided a data base of sufficient detail and focus for dealing with the major research questions of interest.

3.0 Original Variable Definition

The school factors listed in the conceptual-analytical model in the Main Report are major, superordinate categories of related variables. These major categories (e.g., teacher characteristics) are composed of specific variables. These variables and their possible interactions provided the data base for the analyses of program effectiveness. Therefore, in order to provide the reader with a complete understanding of which variables were used in the study, they are listed here under their respective higher-level categories of school and school-related factors.

INPUTS:

A. Instructional Time Variables for each student included the number of minutes per week of

1. Total Reading Instruction.
2. All Whole Group Reading Instruction.
3. All Small Group Reading Instruction.
4. All Individual Help in Reading.
5. All Individualized Reading Instruction.
6. All Specialist Reading Insturction.
7. All Paid Aide Reading Instruction.
8. All Unpaid Aide Reading Instruction.
9. Whole Group Instruction by the Teacher.
10. Small Group Instruction by the Teacher.

11. Individual Help by the Teacher.

12. Individualized Instruction by the Teacher.

B. Instructional Mode Variables indicated whether a student received

13. Whole Group Instruction by the Teacher.

14. Small Group Instruction by the Teacher.

15. Individual Help by the Teacher.

16. Individualized Instruction by the Teacher.

17. Total Whole Group Instruction.

18. Total Small Group Instruction.

19. Total Individual Help.

20. Total Individualized Instruction.

C. Instructional Materials Variables[a] were subsumed in an index (Variable Number 21) based upon the type and number of materials used for reading instruction in the teacher's classroom.

D. Individual Student Characteristic Variables included

22. Age.

23. Sex.

24. Birth Order.

25. Father's Occupation.

26. Father's Education.

27. Mother's Occupation.

28. Mother's Education.

29. 3rd Grade Reading Ability (PEP TEST) as a raw score.

30. 3rd Grade Math Ability (PEP TEST) as a raw score.

31. Number of Days Absent.

32. Percentage of Days Present.

33. Membership in a Specific Reading Class.

---

[a] See Section 2.0 for a thorough description of the Index of Materials Resource Utilization.

34. Membership in a Specific School.

35. Student raw score on criterion-referenced test, 1st administration at Levels 2, 3, 4, 5, 6, 7.

36. Student Achievement Development Scale Score on the May, 1973 and January, 1974, California Achievement Test for vocabulary, comprehension, and total reading.

E. Individual Teacher Characteristic Variables included

37. Age.

38. Sex.

39. Degree Status.

40. Total Years of Experience.

41. Type of Appointment.

42. Teacher Expectancy of Student Performance under real conditions.

43. Teacher Expectancy of Student Performance under ideal conditions.

44. Ideal minus Real Teacher Expectancy.

45. Number of undergraduate courses related to reading.

46. Number of graduate courses related to reading.

47. Number of inservice hours/month.

48. Minutes per week of teacher preparation for reading.

49. Minutes per week of teacher coordination time for reading.

F. Student Body Characteristics of Reading Class Variables included

50. Number of Students.

51. Percentage of White Students.

52. Percentage of Black Students.

53. Percentage of Spanish Surnamed Students.

54. Frequency of change in reading group composition.

55. Percentage Working Poor or Unemployed.

56. Percentage Unskilled Workers.

57. Percentage Skilled Blue Collar.

58. Percentage Skilled White Collar.

59. Percentage Management Level.

60. Percentage Professional.

61. Percentage Working Poor/Unemployed plus Unskilled Workers.

G. School Characteristics Variables included

62. Ability Grouping Practices

H. Interactions of Input Variables included

63. High Performing Students by Minutes Per Week (MPW), Whole Group Instruction (WGI), Small Group Instruction (SGI), Individual Help (IH), and Individualized Instruction (II) by the Teacher.

64. Low Performing Students by MPW, WGI, SGI, IH, II by the Teacher.

65. MPW Total Reading Instruction by Student Sex, Student Age, Number of Days Absent, Number of Pupils in Reading Class, High and Low Performing Students, and Teacher Experience.

66. Student Sex by Teacher Sex.

67. Teacher Age by Teacher Age.

68. Teacher Experience by Teacher Experience.

69. Instructional Materials by High Performing Students, Low Performing Students, and Teacher Preparation Time.

OUTPUTS:

I. Student Reading Achievement on Criterion-Referenced Tests included

69-74. Student raw score on 4th administration of CRT at Levels 2, 3, 4, 5, 6, 7.

J. Student Reading Achievement on Norm-Referenced Test included

75. Student post test vocabulary Achievement Development Scale Score (ADSS) on June 1974 CAT.

76. Student post test comprehension ADSS on June 1974 CAT.

77. Student post test total reading ADSS on June 1974 CAT.

Most of these variables were eventually included in a principal-components analysis. Thus, data reduction procedures, both logical and empirical, resulted in as few as 8 explanatory variables in many of the multiple regression analyses.

4.0 Coding Scheme for Original Variables

In coding the original variables for computer analysis, provisions had to be made for continuous as well as categorical variables. The coding scheme that follows indicates the range allowed for continuous variables and the values assigned to each category of the categorical variables. For cases having missing values for particular variables, the mean for that variable was substituted.

Variables		Code
District Number:	Utica	33.
	Yonkers	44.
	Syracuse	55.
	Brentwood	88.
Year of Study		00. - 99.
School Number		00. - 99.
Student I.D.		000000. - 999999.
Reading Teacher Number		00. - 99.
minutes per week Reading Instruction		000. - 999.
Criterion Referenced Test Raw Scores		000.0 - 999.9

Student Age in Half Years:

Birthdate	
June 1, 1969 - Nov. 30, 1969	09.0
Dec. 1, 1968 - May 31, 1969	10.0
June 1, 1968 - Nov. 30, 1968	11.0
Dec. 1, 1967 - May 31, 1968	12.0
June 1, 1967 - Nov. 30, 1967	13.0
Dec. 1, 1966 - May 31, 1967	14.0
June 1, 1966 - Nov. 30, 1966	15.0
Dec. 1, 1965 - May 31, 1966	16.0
June 1, 1965 - Nov. 30, 1965	17.0
Dec. 1, 1964 - May 31, 1965	18.0
June 1, 1964 - Nov. 30, 1964	19.0
Dec. 1, 1963 - May 31, 1964	20.0
June 1, 1963 - Nov. 30, 1963	21.0
Dec. 1, 1962 - May 31, 1963	22.0
June 1, 1962 - Nov. 30, 1962	23.0
Dec. 1, 1961 - May 31, 1962	24.0
June 1, 1961 - Nov. 30, 1961	25.0
Dec. 1, 1960 - May 31, 1961	26.0
June 1, 1960 - Nov. 30, 1960	27.0
Dec. 1, 1959 - May 31, 1960	28.0
June 1, 1959 - Nov. 30, 1959	29.0
Dec. 1, 1958 - May 31, 1959	30.0

Student Sex:	Male	01.0
	Female	02.0

Birth Order:	First Born	09.0
	Second Born	08.0
	Third Born	07.0
	Fourth Born	06.0
	Fifth Born	05.0
	Sixth Born	04.0
	Seventh Born	03.0
	Eighth Born	02.0
	Ninth Born Plus	01.0
Father's Occupation:	Working Poor (welfare/unemployed)	01.0
	Unskilled Worker (gas station attendant)	02.0
	Skilled Worker-Blue Collar (fireman, electrician)	03.0
	Skilled Worker-White Collar (office worker, sales)	04.0
	Business (management)	05.0
	Professional (doctor, teacher)	06.0
Father's Education:	None, or some grade school	01.0
	Completed grade school	02.0
	Some high school, but did not graduate	03.0
	Graduated from high school	04.0
	Vocational or business school after high school	05.0
	Some college, but less than 4 years	06.0
	Graduated from a 4-year college	07.0
	Attended graduate or professional school	08.0
	Not available	09.0

Mother's Occupation:	Working Poor (welfare/unemployed)	01.0
	Unskilled Worker (gas station attendant)	02.0
	Skilled Worker-Blue Collar (fireman, electrician)	03.0
	Skilled Worker-White Collar (office worker, sales)	04.0
	Business (management, sales)	05.0
	Professional (doctor, teacher)	06.0
	Housewife	07.0
Mother's Education:	None, or some grade school	01.0
	Completed grade school	02.0
	Some high school, but did not graduate	03.0
	Graduated from high school	04.0
	Vocational or business school after high school	05.0
	Some college, but less than 4 years	06.0
	Graduated from a 4-year college	07.0
	Attended graduate or professional school	08.0
	Not available	09.0
Pupil Evaluation Program (PEP) Reading Test Raw Score		00.0-99.9
Number of Days Absent		00.0 - 99.9
Percent of Days Present		00.0 - 99.9

Classroom Ethnicity:	Number of Students in Reading Class	00.0 - 99.9
	Number of White Students	00.0 - 99.9
	Number of Black Students	00.0 - 99.9
	Number of Oriental Students	00.0 - 99.9
	Number of Spanish Students	00.0 - 99.9
	Number of American Indian Students	00.0 -99.9
Classroom SES: (Occupation of head of household)	Number of Working Poor	00.0 - 99.9
	Number of Unskilled Workers	00.0 - 99.9
	Number of Skilled Workers-Blue Collar	00.0 - 99.9
	Number of Skilled Workers-White Collar	00.0 - 99.9
	Number of Business Management	00.0 - 99.9
	Number of Professionals	00.0 - 99.9
Number of Absentees in Classroom per Day		00.0 - 99.9
Number of Students Moving into Class during Year		00.0 - 99.9
Number of Students Moving out of Class during Year		00.0 - 99.9
Educational Attainment Under Existing Conditions: (Teacher Expectancy)		
	8th grade or less	01.0
	9th, 10th, or 11th grade	02.0
	High School Graduate	03.0
	Jr. College, Business	04.0
	4 year college or more	05.0
Educational Attainment Under Ideal Conditions: (Teacher Expectancy)		
	8th grade or less	01.0
	9th, 10th, Or 11th grade	02.0
	High School Graduate	03.0
	Jr. College, Business	04.0
	4 year college or more	05.0

Frequency of Change in Reading Group Composition:		
	No change Sept. - June	01.0
	Little change (every 5 mo.)	02.0
	Some change (every 3-4 mo.)	03.0
	Much change (every 2 mo.)	04.0
Number of Undergraduate Courses in Reading Instruction		00.0 - 99.9
Number of Graduate Courses in Reading Instruction		00.0 - 99.9
mpw of Teacher Preparation for Reading Instruction		00.0 - 99.9
mpw of Teacher Coordination of Reading Instruction		00.0 - 99.9
Teacher Absences:	Teacher not absent 2 consecutive weeks	01.0
	Teacher absent for 2 consecutive weeks	02.0
mpw of Non-instructional Reading Activities		000.0 - 999.9
Teacher Sex:	Male	01.0
	Female	02.0
Teacher Age:	Year of Birth	00.0 - 99.9
Teacher Certification:	None	01.0
	5 yr. provisional	02.0
	10 yr. provisional	03.0
	NYCS - Substitute	04.0
	NYCS - Probationary	05.0
	Buffalo Temporary	06.0
	Buffalo Probationary	07.0
	Permanent	08.0
Teacher Degree Status:	Freshman year or less	01.0
	Soph. year completed	02.0
	Associate degree	03.0
	Junior year or less	04.0
	Bachelors degree	05.0
	Bachelors degree + 30 hr.	06.0
	Masters degree	07.0
	Masters degree + 30 hr.	08.0
	Doctorate	09.0
Total Years Teaching Experence		00.0 - 99.9

Type of Appointment:	Civil Service	01.0
	Substitute	02.0
	Probationary	03.0
	Tenured	04.0
Index of Material Resource Utilization		00. - 99.
California Achievement Test Reading ADGS Scores		000.0 - 999.9

4.1 Coding Scheme of Transgenerated Variables

In addition to the original variables already listed, the following new variables were created from the original variables by transgenerations.

Dummy Variables for District and School. Each district and school building was assigned a unique variable. Each student was then assigned a value of 1 if in a particular district or school. He received a value of 0 in all other dummy variables for district and school.

Minutes per Year (mpy) of Reading Instruction. In an effort to use a more accurate estimate of time spent in reading instruction for each student, each of the time variables recorded in minutes per week was transgenerated into minutes per year. This involved the number of school days per week, the average number of school days in a school year, and the percentage of days present for each student. This transgeneration is summarized in the following formula:

$$\text{MPY} = \frac{\text{mpw}}{5} \times 181.8 \text{ days} \times \% \text{ days present.}$$

Teacher's Age. The teacher's age was determined by subtracting the teacher's year of birth from 74 (1974):

Teacher's Age= 74- date of birth.

Percent of White Students in Reading Class. Percentages of reading class ethnicity (white, black, etc.) and SES (working poor, unskilled worker, etc.) were determined by dividing the number of students in each category by the total number of students in the reading class and multiplying by 100. For example:

$$\%\text{ white students in class} = \frac{\text{number of white students}}{\text{total number of students}} \times 100$$

Logarithmic Transformation. Natural logarithms of all time variables were also generated in order to make their relationships in the regression models more linear. -

z-scores. While examining interaction effects, these variables were standardized using z-scores obtained by dividing the difference between the raw score and mean by its standard deviation or

$$Z_i = \frac{X_i - \bar{X}_i}{SD_x}$$

5.0 Frequency Distributions of Major Original Variables

The following histograms were plotted using a subsample of 2672 students across all districts in the study. The plots were made using raw data. Intervals and ranges were determined by the computer program (BMD 05D). Variables having a high frequency of zeros or appearing to have low variability were plotted using another program (BMD 07D) which allowed for the selection of special values from the distribution and provided the exact frequency count for each interval.

Figure 5.1 Distribution of mpw Whole Group Instruction by Teacher

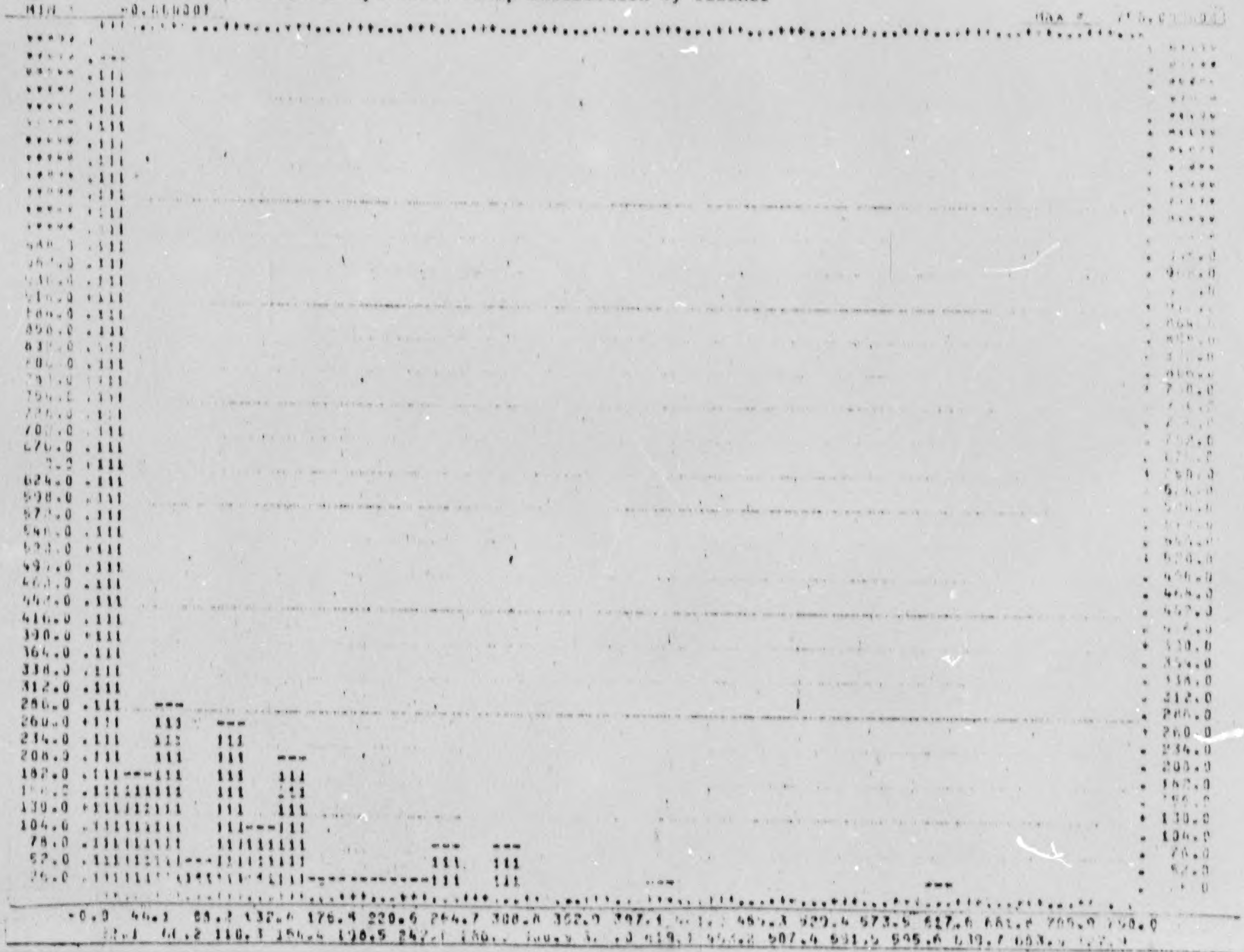


Figure 5.2 Distribution of Small Group Instruction by Teacher

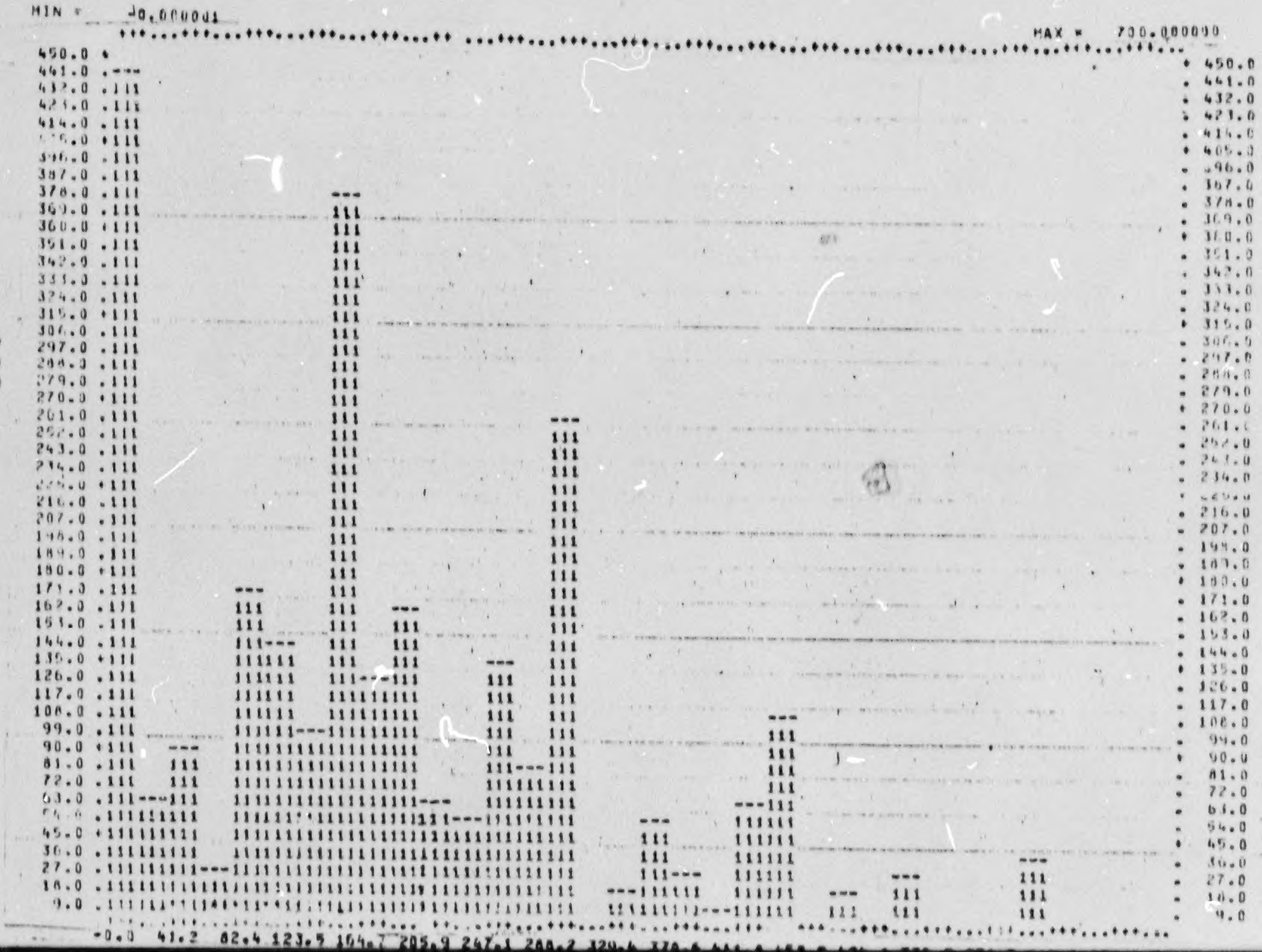


Figure 5.3 · Distribution of mpw Individual Help by Teacher

```
 SPECIAL
  VALUES

   0.000 )*******2008

            TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL

 108.000 )
 104.000 )
 100.000 )*
  96.000 )
  92.000 )
  88.000 )
  84.000 )
  80.000 )
  76.000 )
  72.000 )***
  68.000 )
  64.000 )
  60.000 )****
  56.000 )
  52.000 )
  48.000 )
  44.000 )
  40.000 )
  36.000 )
  32.000 )***
  28.000 )*********26
  24.000 )*********24
  20.000 )*********24
  16.000 )
  12.000 )*********46
   8.000 )********189
   4.000 )*********97
   0.000 )********247
  -4.000 )
  -8.000 )

MEAN         8.907
S DEV       10.230
 N         664.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

             MEAN          8.9066
             S DEV        10.2297
             MAXIMUM     100.0000
             MINIMUM       1.0000
```

(PRINTED INTERVAL DESIGNATIONS ARE
LOWER LIMITS OF CLASS INTERVALS)

Figure 5.4 Distribution of mpw Individualized Instruction by Teacher

```
 SPECIAL
  VALUES

   0.000 )*******2472

         TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL

 320.000 )
 310.000 )*********14
 300.000 )*********53
 290.000 )
 280.000 )
 270.000 )
 260.000 )
 250.000 )
 240.000 )
 230.000 )*
 220.000 )
 210.000 )*********25
 200.000 )*********40                    (PRINTED INTERVAL DESIGNATIONS ARE
 190.000 )**                              LOWER LIMITS OF CLASS INTERVALS)
 180.000 )
 170.000 )
 160.000 )
 150.000 )***
 140.000 )
 130.000 )*********20
 120.000 )
 110.000 )*
 100.000 )
  90.000 )
  80.000 )
  70.000 )*********23
  60.000 )
  50.000 )
  40.000 )*********18
  30.000 )

 MEAN      200.125
 S DEV      90.862
 N         200.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

          MEAN        200.1250
          S DEV        90.8619
          MAXIMUM     315.0000
          MINIMUM      40.0000
```

Figure 5.5 Distribution of Total mpw Small Group Instruction

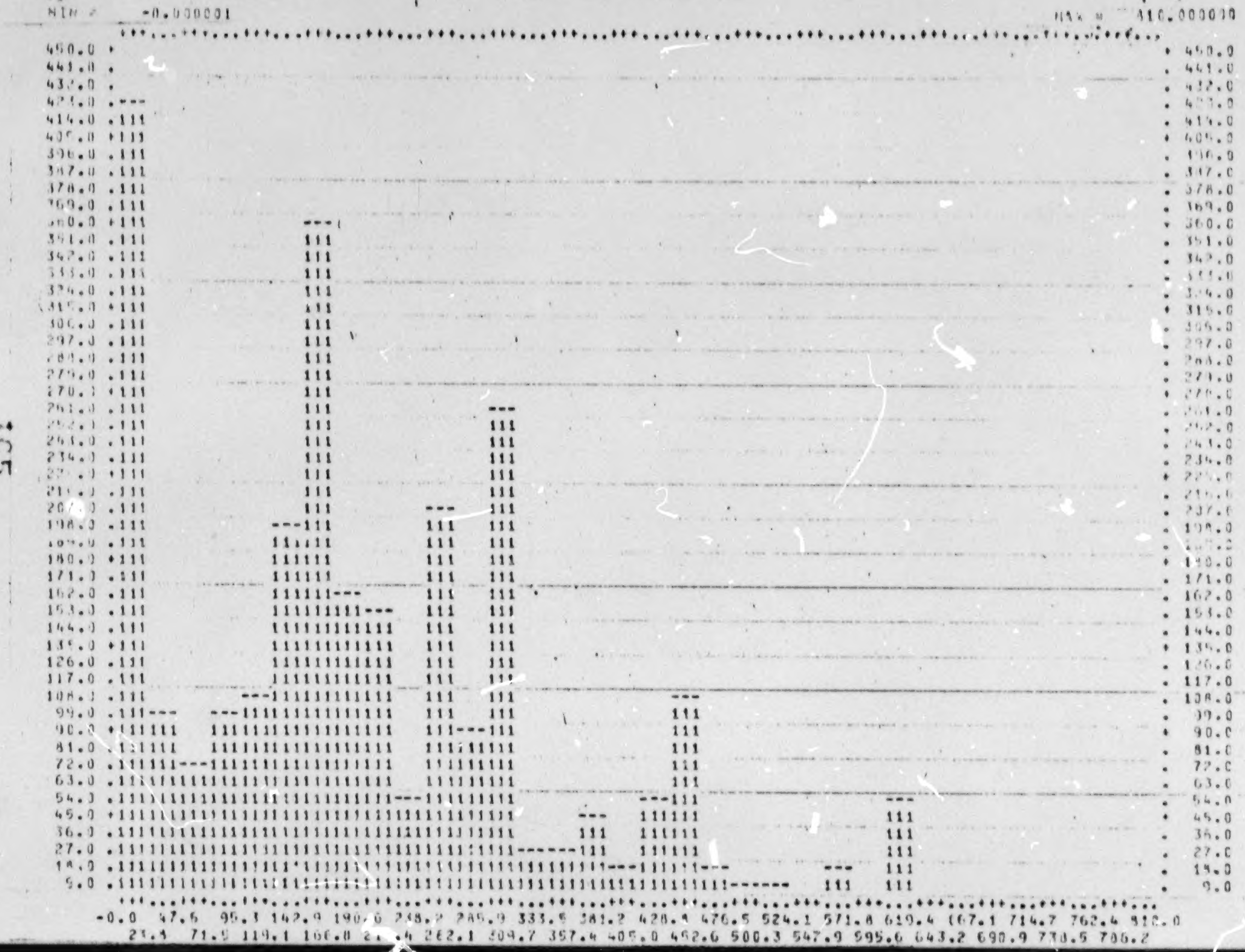


Figure 5.6 Distribution of Total mpw Individual Help

```
 SPECIAL
  VALUES

   0.000 )********1894

          TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL


 540.000 )
 520.000 )
 500.000 )*
 480.000 )
 460.000 )
 440.000 )
 420.000 )
 400.000 )
 380.000 )
 360.000 )**
 340.000 )
 320.000 )
 300.000 )***
 280.000 )*                         (PRINTED INTERVAL DESIGNATIONS ARE
 260.000 )                           LOWER LIMITS OF CLASS INTERVALS)
 240.000 )
 220.000 )**
 200.000 )
 180.000 )*****
 160.000 )***
 140.000 )***********39
 120.000 )***********14
 100.000 )***********12
  80.000 )***********20
  60.000 )***********22
  40.000 )********
  20.000 )**********101
   0.000 )**********546
 -20.000 )
 -40.000 )

  MEAN      29.060
  S DEV     53.107
   N       778.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

          MEAN        29.0604
          S DEV       53.1072
          MAXIMUM    500.0000
          MINIMUM      1.0000
```

106

Figure 5.7 Distribution of Total mpw Individualized Instruction

```
 SPECIAL
  VALUES


   0.000 )********2155

        TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL


 720.000 )
 690.000 )
 660.000 )
 630.000 )
 600.000 )**
 570.000 )
 540.000 )******
 510.000 )*
 480.000 )***
 450.000 )
 420.000 )*
 390.000 )*******
 360.000 )**********14
 330.000 )
 300.000 )**********73
 270.000 )**
 240.000 )*******
 210.000 )**********18                     (PRINTED INTERVAL DESIGNATIONS ARE
 180.000 )**********56                      LOWER LIMITS OF CLASS INTERVALS)
 150.000 )**********30
 120.000 )**********62
  90.000 )**********81
  60.000 )**********81
  30.000 )**********38
   0.000 )**********38
 -30.000 )
 -60.000 )
 -90.000 )
-120.000 )
-150.000 )

 MEAN      156.128
 S DEV     114.931
  N        517.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

         MEAN        156.1277
         S DEV       114.9309
         MAXIMUM     620.0000
         MINIMUM       7.0000
```

Figure 5.8 Distribution of Total mpw Teacher Instruction

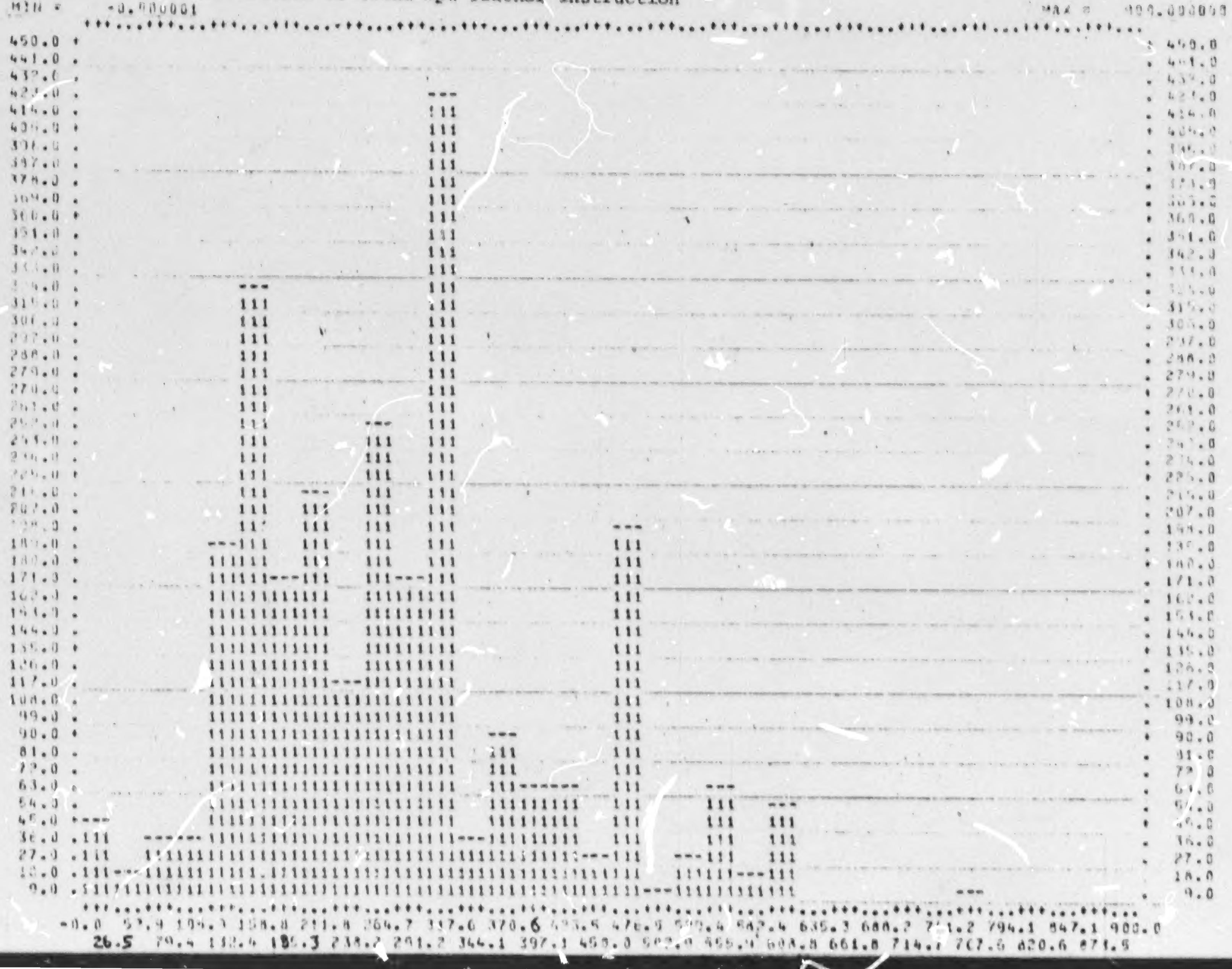


Figure 5.9 Distribution of Total mpw Specialist Instruction

```
SPECIAL
 VALUES

  0.000 )*******2291

          TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

720.000 )
690.000 )
660.000 )
630.000 )
600.000 )**
570.000 )
540.000 )*****
510.000 )
480.000 )***
450.000 )*
420.000 )**
390.000 )******
360.000 )**                         (PRINTED INTERVAL DESIGNATIONS ARE
330.000 )                            LOWER LIMITS OF CLASS INTERVALS)
300.000 )**********
270.000 )**
240.000 )*******
210.000 )***
180.000 )*********12
150.000 )*********40
120.000 )*********68
 90.000 )*********61
 60.000 )*********89
 30.000 )*********30
  0.000 )*********38
-30.000 )
-60.000 )
-[illegible].000 )
-120.000 )
-150.000 )

 MEAN     119.081
 S DEV    106.465
  N       381.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED) .

         MEAN      119.0814
         S DEV     106.4646
         MAXIMUM   620.0000
         MINIMUM     7.0000
```

Figure 5.10   Distribution of Total mpw Paid Aide Instruction

```
 SPECIAL
  VALUES

    0.000 )*******2432

               TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL


 540.000 )
 520.000 )
 500.000 )*
 480.000 )
 460.000 )
 440.000 )*********
 420.000 )
 400.000 )
 380.000 )
 360.000 )
 340.000 )
 320.000 )
 300.000 )*********                              (PRINTED INTERVAL DESIGNATIONS ARE
 280.000 )                                        LOWER LIMITS OF CLASS INTERVALS)
 260.000 )
 240.000 )
 220.000 )****
 200.000 )**********13
 180.000 )***
 160.000 )**********
 140.000 )**********41
 120.000 )**********40
 100.000 )**********14
  80.000 )***********
  60.000 )**********37
  40.000 )**********16
  20.000 )**********36
   0.000 )
 -20.000 )
 -40.000 )

 MEAN      122.887
 S DEV      91.577
  N        240.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

          MEAN       122.8875
          S DEV       91.5772
          MAXIMUM    500.0000
          MINIMUM     20.0000
```

110

Figure 5.11   Distribution of Total mpw Unpaid Aide Instruction

```
SPECIAL
 VALUES


  0.000 )********2629

        TABULATICNS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTEPVAL


165.000 )
160.000 )*
155.000 )
150.000 )*******
145.000 )
140.000 )
135.000 )
130.000 )
125.000 )
120.000 )*******
115.000 )
110.000 )
105.000 )
100.000 )**
 95.000 )
 90.000 )******
 85.000 )
 80.000 )
 75.000 )***                                (PRINTED INTERVAL DESIGNATIONS ARE
 70.000 )                                    LOWER LIMITS OF CLASS INTERVALS)
 65.000 )
 60.000 )****
 55.000 )
 50.000 )
 45.000 )
 40.000 )
 35.000 )
 30.000 )**********13
 25.000 )
 20.000 )

MEAN      84.767
S DEV     45.381
 N        43.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED) .

          MEAN       84.7674
          S DEV      45.3814
          MAXIMUM   160.0000
          MINIMUM    30.0000
```

Figure 5.12 Distribution of Total mpw Reading Instruction

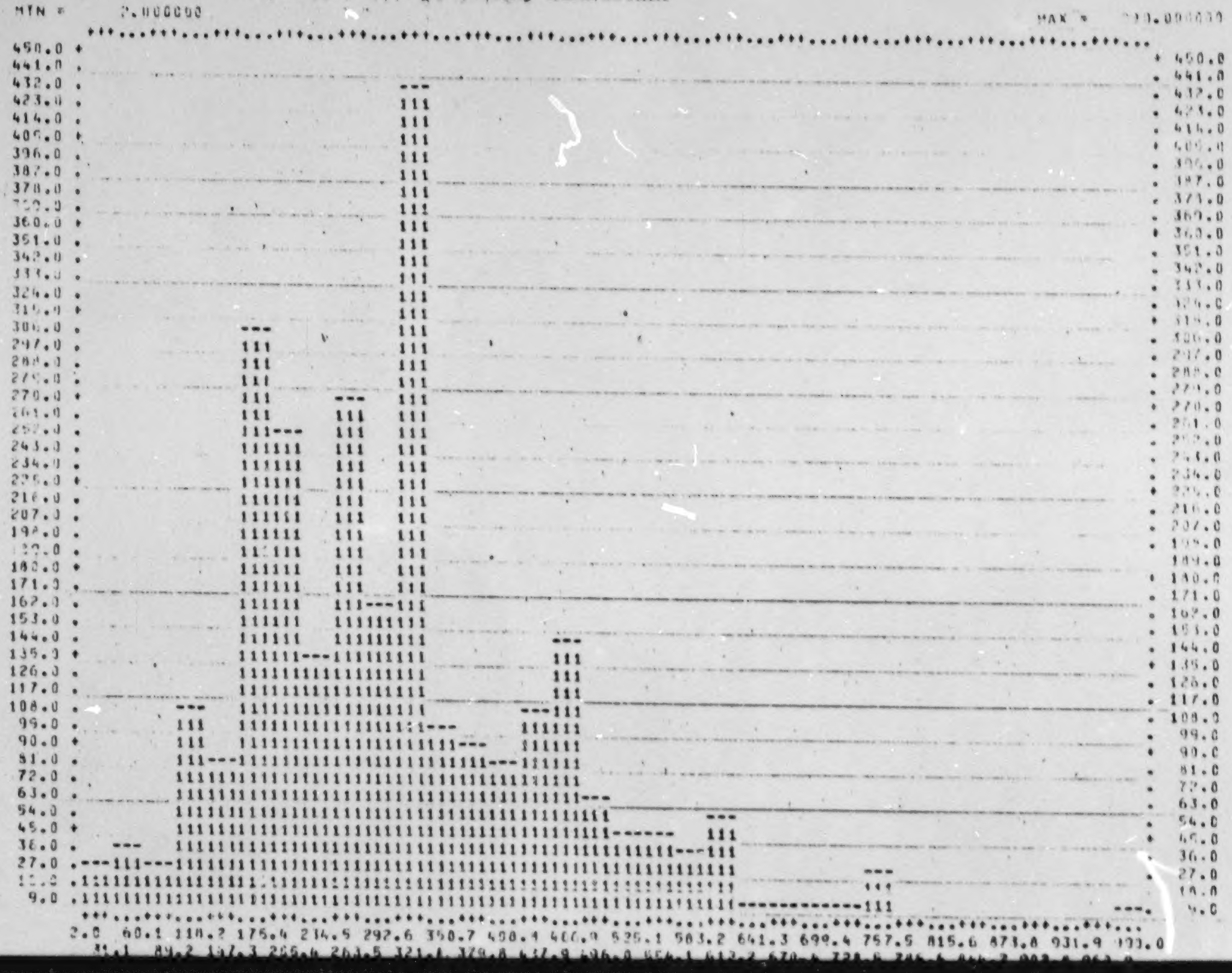


Figure 5.13 Distribution of CRT Level 4, Test Administration 1

```
SPECIAL
 VALUES

  0.000 )********2061

               TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

 72.000 )
 69.000 )
 66.000 )
 63.000 )
 60.000 )**
 57.000 )
 54.000 )
 51.000 )*
 48.000 )
 45.000 )
 42.000 )**
 39.000 )
 36.000 )
 33.000 )*
 30.000 )*
 27.000 )**********
 24.000 )*********44                    (PRINTED INTERVAL DESIGNATIONS ARE
 21.000 )*********72                     LOWER LIMITS OF CLASS INTERVALS)
 18.000 )********115
 15.000 )********122
 12.000 )********130
  9.000 )*********83
  6.000 )*********23
  3.000 )***
  0.000 )**
 -3.000 )
 -6.000 )
 -9.000 )
-12.000 )
-15.000 )

MEAN      16.566
S DEV      5.981
 N       611.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

        MEAN         16.5663
        S DEV         5.9811
        MAXIMUM      61.0000
        MINIMUM       1.0000
```

Figure 5.14 Distribution of CRT Level 4 Test Administration 4

```
 SPECIAL
  VALUES

   0.000 )*******2036

                TABULATICNS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL

   30.000 )*
   29.000 )**
   28.000 )******
   27.000 )*******
   26.000 )*********14
   25.000 )*********19
   24.000 )*********33
   23.000 )*********20
   22.000 )*********20
   21.000 )*********36                          (PRINTED INTERVAL DESIGNATIONS ARE
   20.000 )*********29                           LOWER LIMITS OF CLASS INTERVALS)
   19.000 )*********24
   18.000 )*********40
   17.000 )*********34
   16.000 )*********49
   15.000 )*********51
   14.000 )*********44
   13.000 )*********51
   12.000 )*********41
   11.000 )*********36
   10.000 )*********25
    9.000 )*********18
    8.000 )*********17
    7.000 )********
    6.000 )*****
    5.000 )**
    4.000 )***
    3.000 )
    2.000 )*
    1.000 )

 MEAN       16.415
 S DEV       5.293
  N        636.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED) .

        MEAN        16.4151
        S DEV        5.2931
        MAXIMUM     30.0000
        MINIMUM      2.0000
```

Figure 5.15 Distribution of CRT Level 5 Test Administration 1

```
SPECIAL
 VALUES

  0.000 )*******2147

        TABULATIONS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

 43.500 )
 42.000 )*
 40.500 )
 39.000 )
 37.500 )
 36.000 )*
 34.500 )
 33.000 )*
 31.500 )**
 30.000 )*********11
 28.500 )******
 27.000 )*********24
 25.500 )*********26                        (PRINTED INTERVAL DESIGNATIONS ARE
 24.000 )*********40                         LOWER LIMITS OF CLASS INTERVALS)
 22.500 )*********33
 21.000 )*********54
 19.500 )*********25
 18.000 )*********55
 16.500 )*********21
 15.000 )*********63
 13.500 )*********31
 12.000 )*********63
 10.500 )*********23
  9.000 )*********26
  7.500 )**********
  6.000 )******
  4.500 )**
  3.000 )**
  1.500 )
  0.000 )

MEAN      18.297
S DEV      6.046
 N       525.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

          MEAN        18.2971
          S DEV        6.0462
          MAXIMUM     42.0000
          MINIMUM      4.0000
```

Figure 5.16 Distribution of CRT Level 5 Test Administration 4

```
 SPECIAL
  VALUES

   0.000 )*******2143

          TABULATICNS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL


  40.500 )
  39.000 )
  37.500 )
  36.000 )
  34.500 )
  33.000 )**
  31.500 )****
  30.000 )**********14
  28.500 )**********13
  27.000 )**********37
  25.500 )**********33
  24.000 )**********45
  22.500 )**********28
  21.000 )**********44
  19.500 )**********19
  18.000 )**********41
  16.500 )**********22
  15.000 )**********75
  13.500 )**********30
  12.000 )**********65
  10.500 )**********15
   9.000 )**********22
   7.500 )*
   6.000 )**********14
   4.500 )***
   3.000 )**
   1.500 )
   0.000 )
  -1.500 )
  -3.000 )

 MEAN      18.866
 S DEV      6.351
  N       529.
                                                                        (PRINTED INTERVAL DESIGNATIONS AR
                                                                         LOWER LIMITS OF CLASS INTERVALS)
ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED) .

          MEAN        18.8658
          S DEV        6.3508
          MAXIMUM     34.0000
          MINIMUM      4.0000
```

Figure 5.17 Distribution of Student Age in Half Year

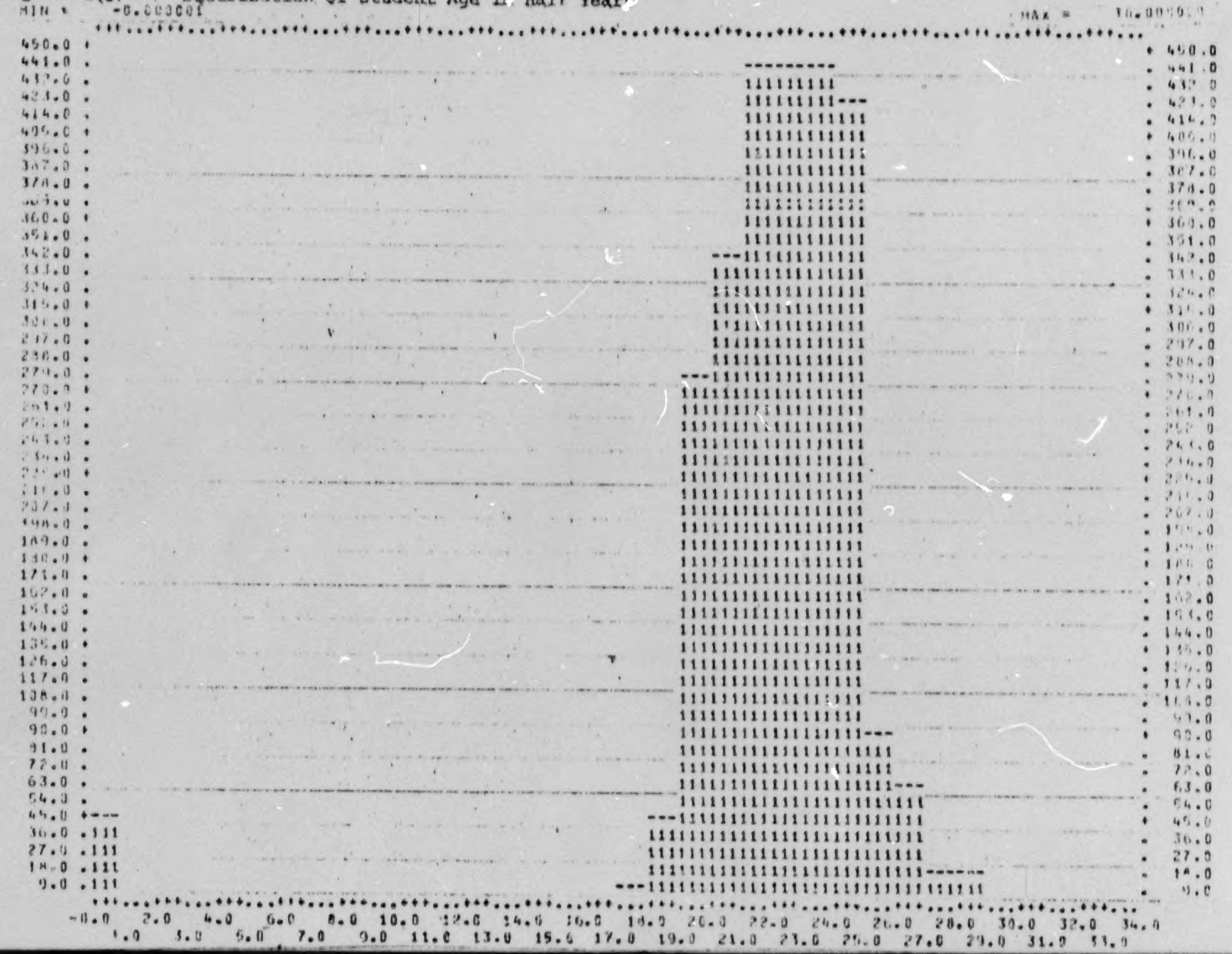


Figure 5.18 Distribution of Student Sex (Male=1, Female=2)

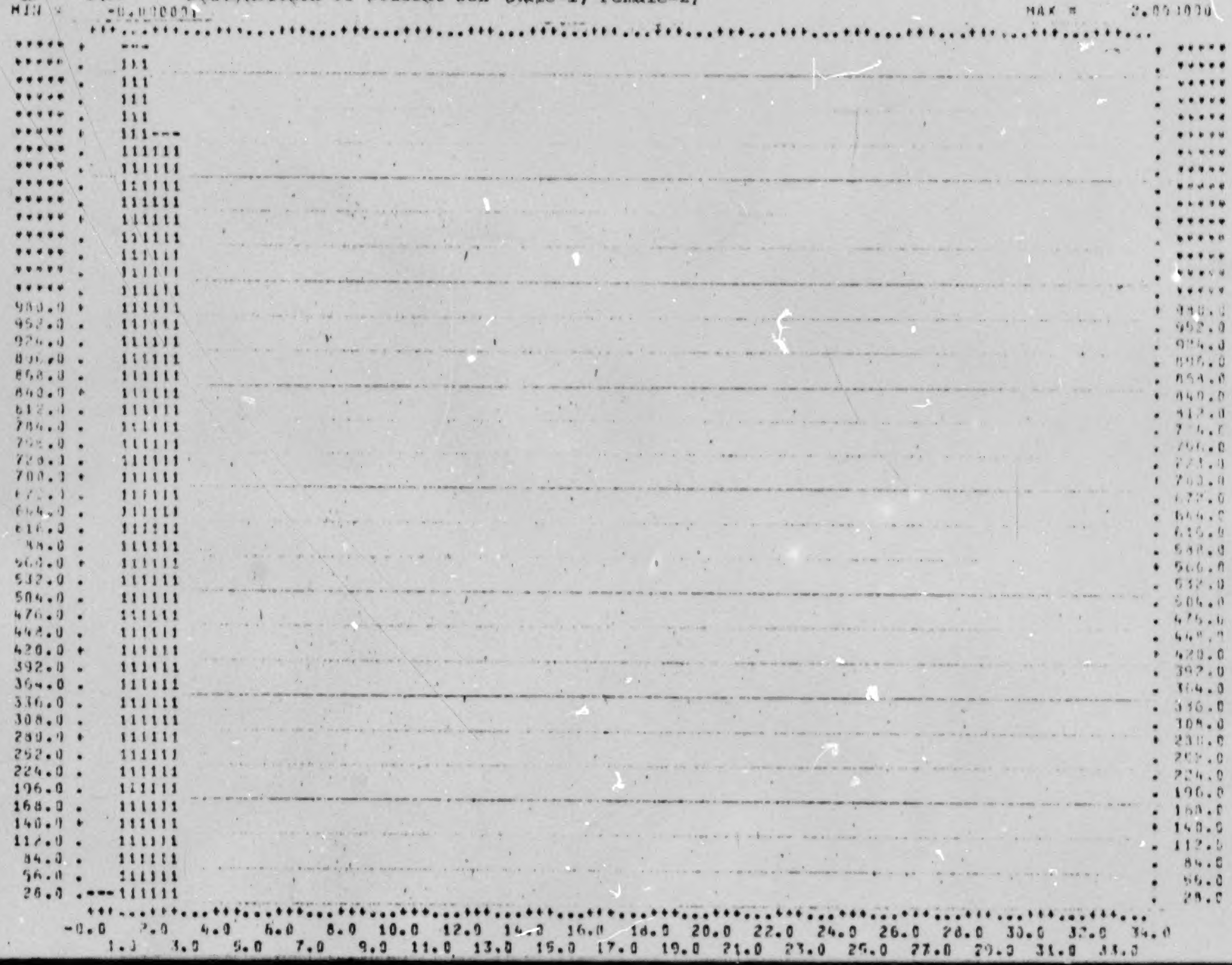


Figure 5.15 Distribution of Student Birth Order in Family

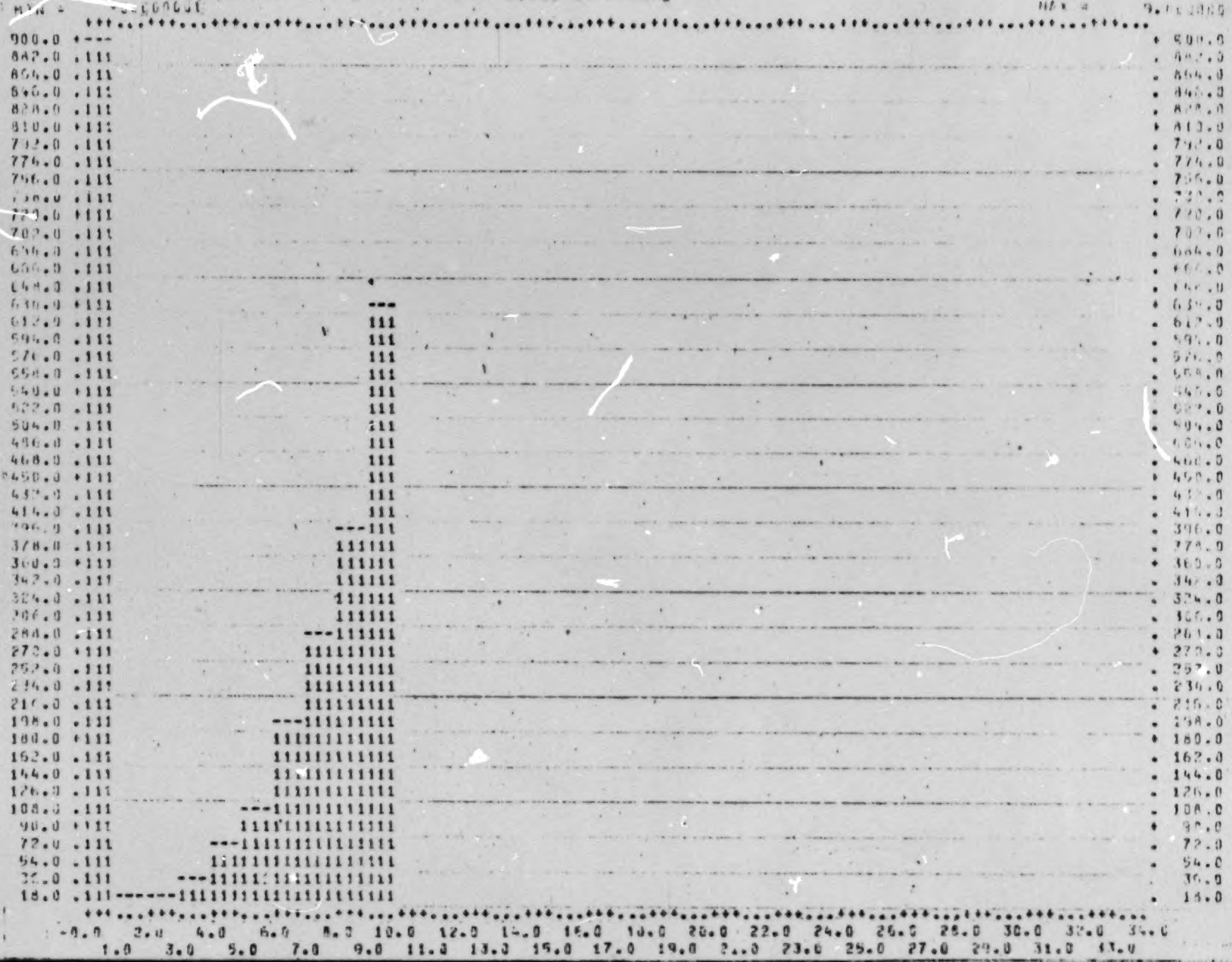


Figure 5.20 Distribution of Father's Occupation

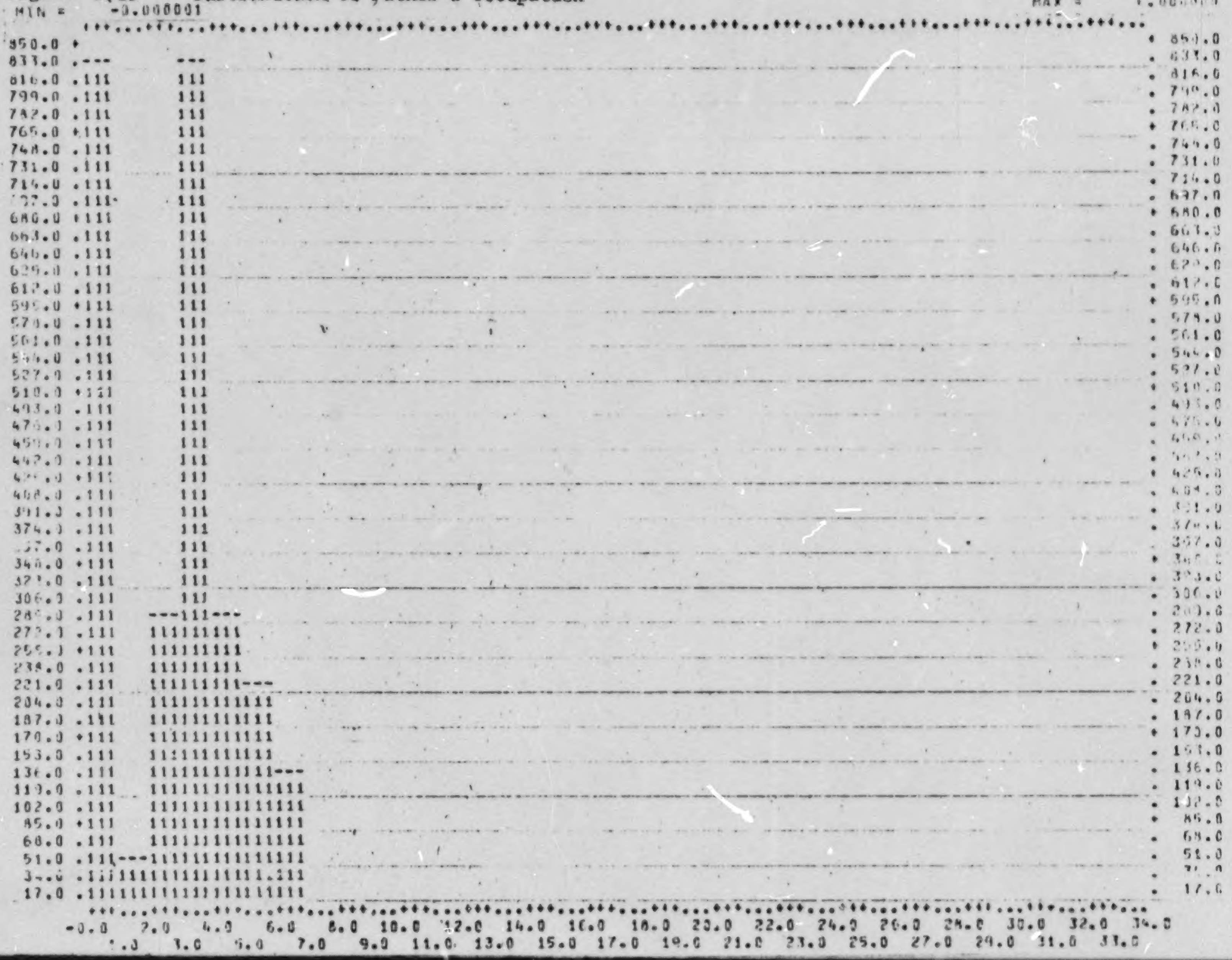


Figure 5.21 Distribution of Father's Education

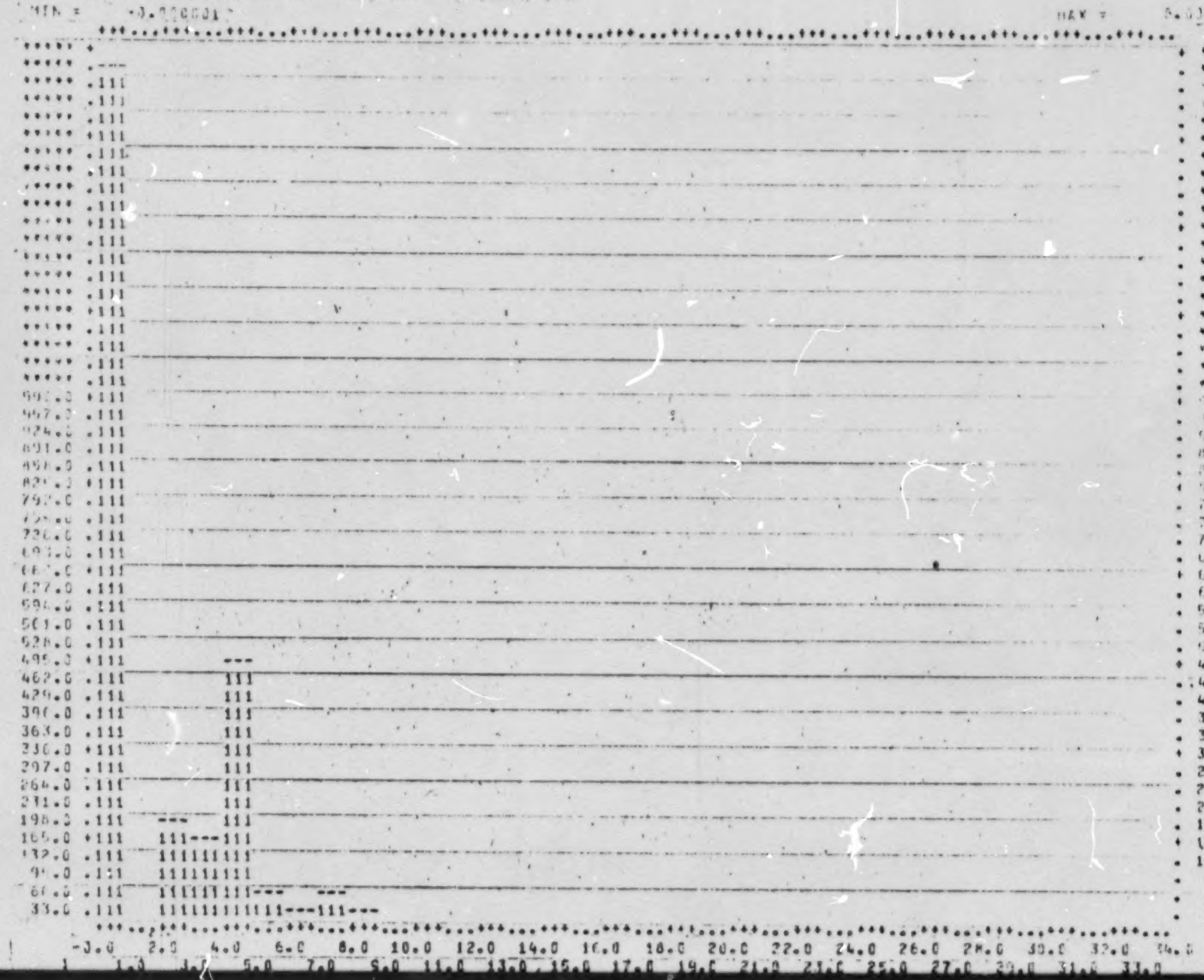


Figure 5.22 Distribution of Mother's Occupation

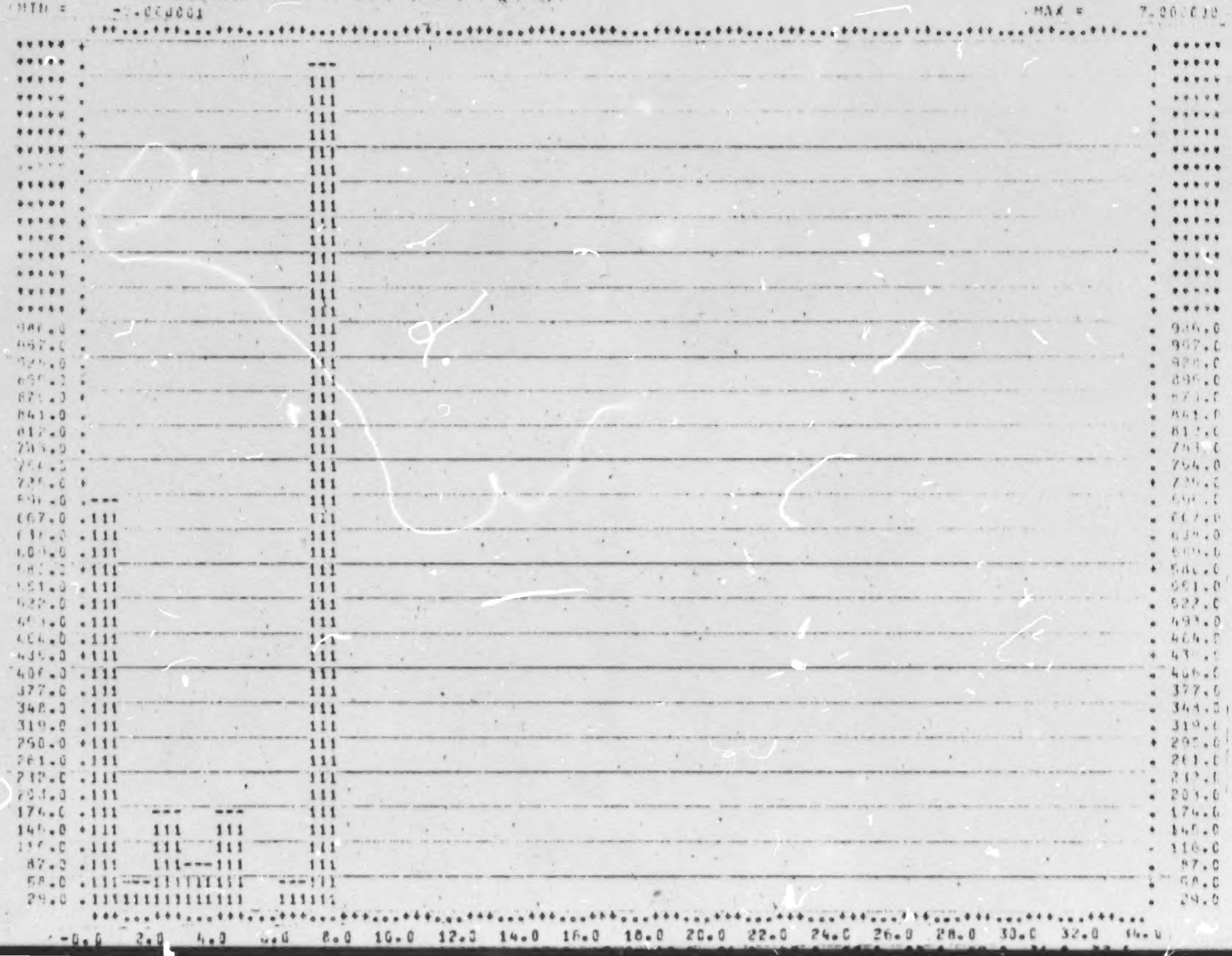


Figure 5.23 Distribution of Mother's Education

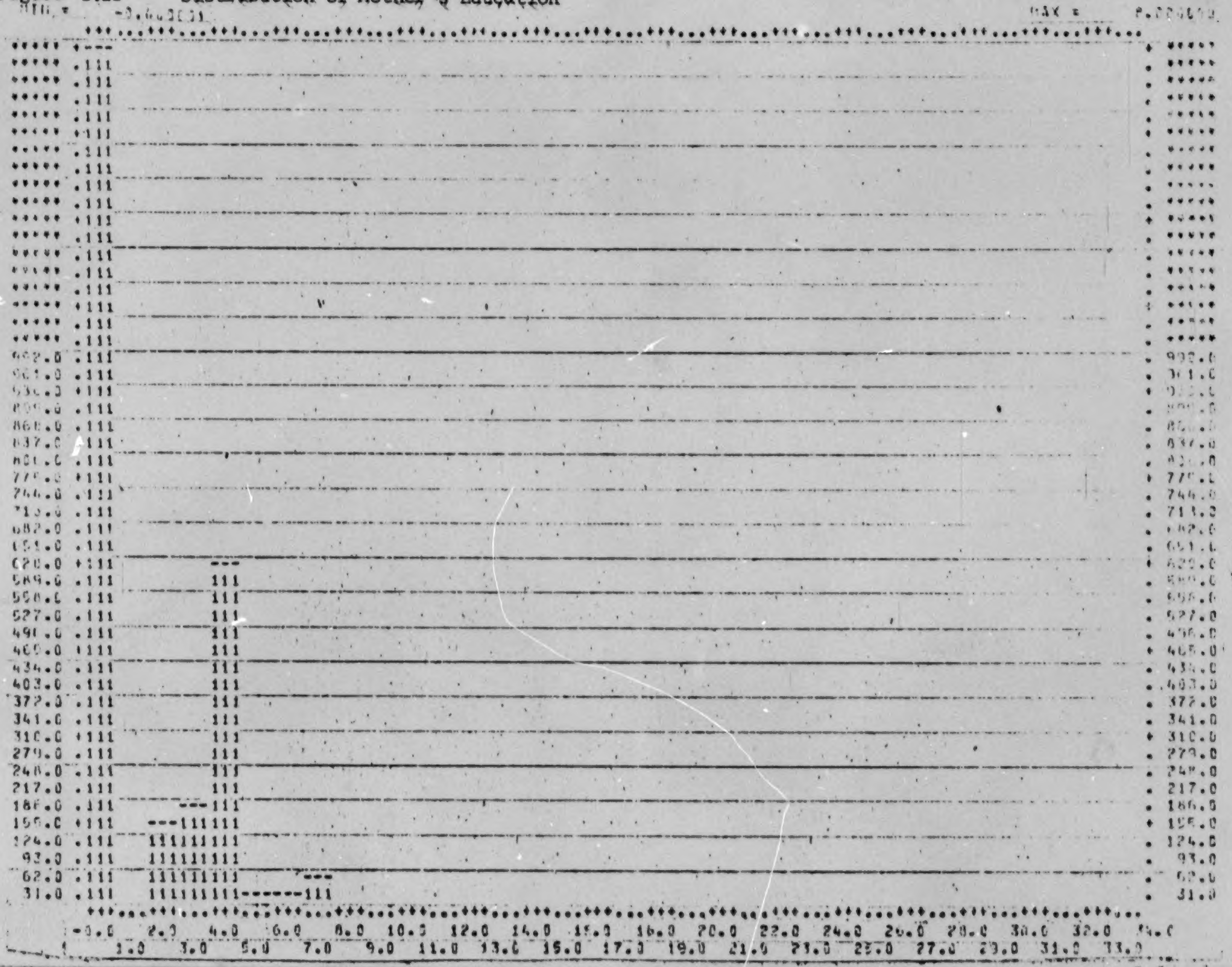


Figure 5. 24 Distribution of 3rd Grade PEP Reading Test-Raw Score

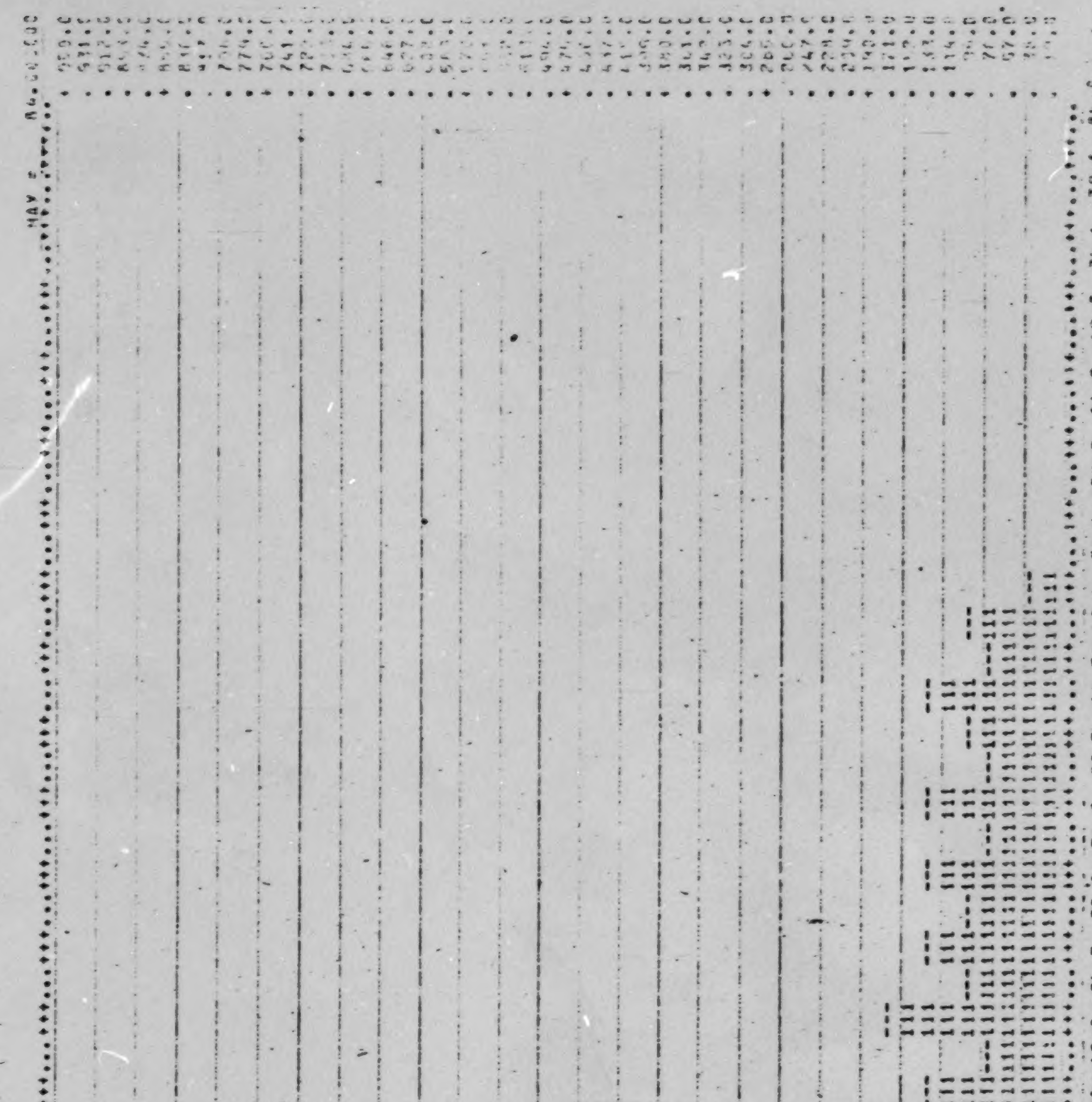


Figure 5.25 Distribution of Number of Days Student Was Absent

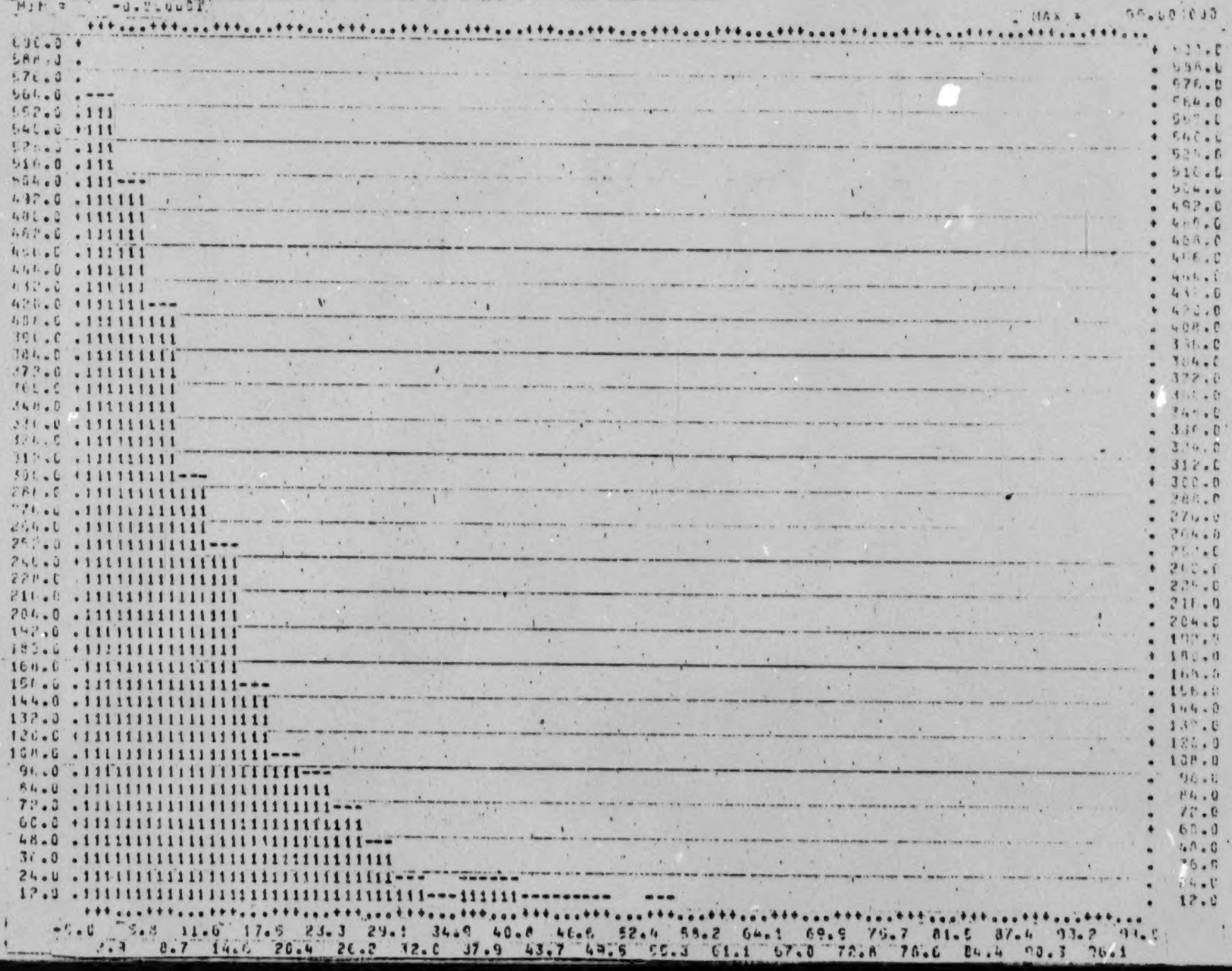


Figure 5.26 Distribution of Percent of Days Student Was Present

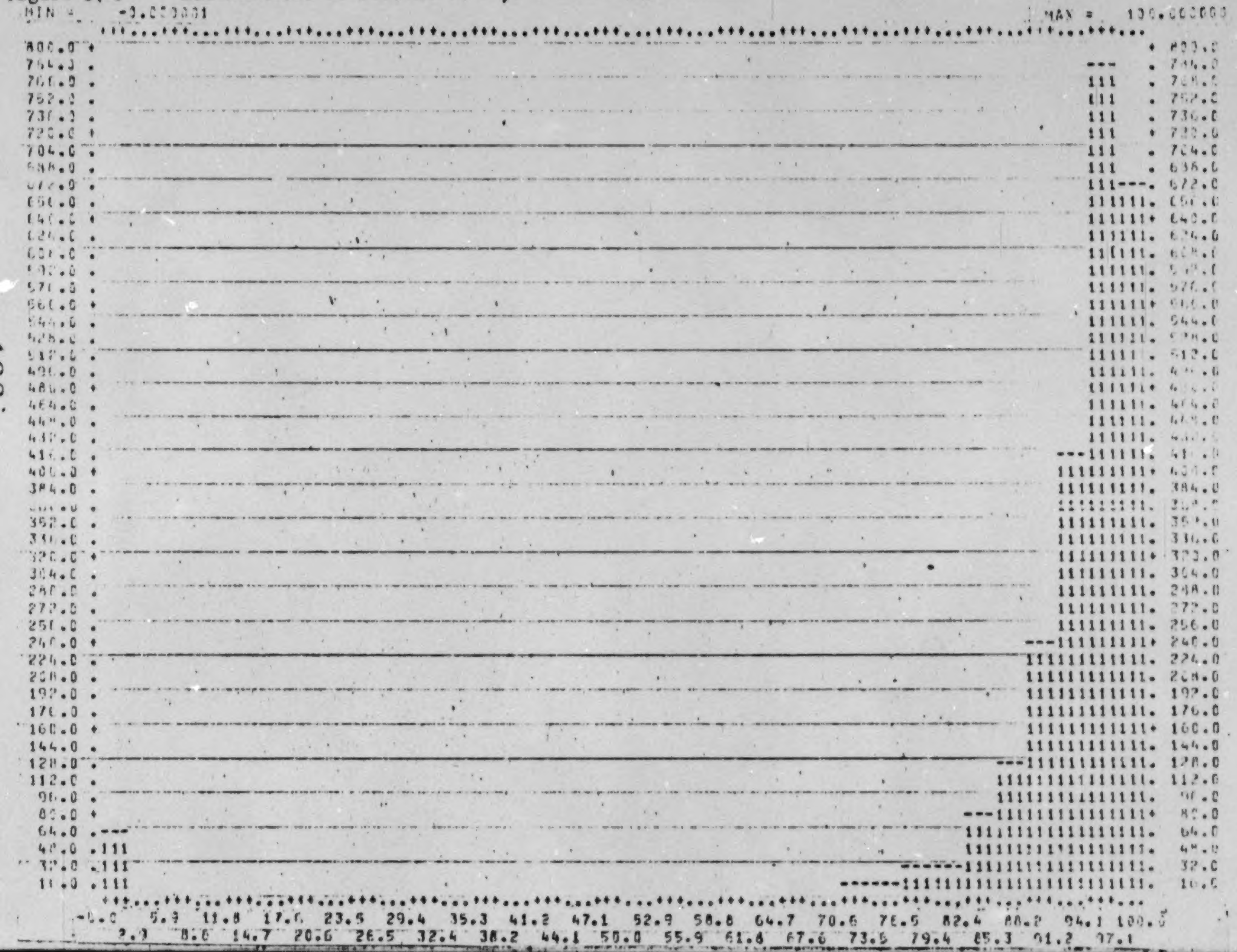


Figure 5.27 Distribution of the Number of Students in Reading Class

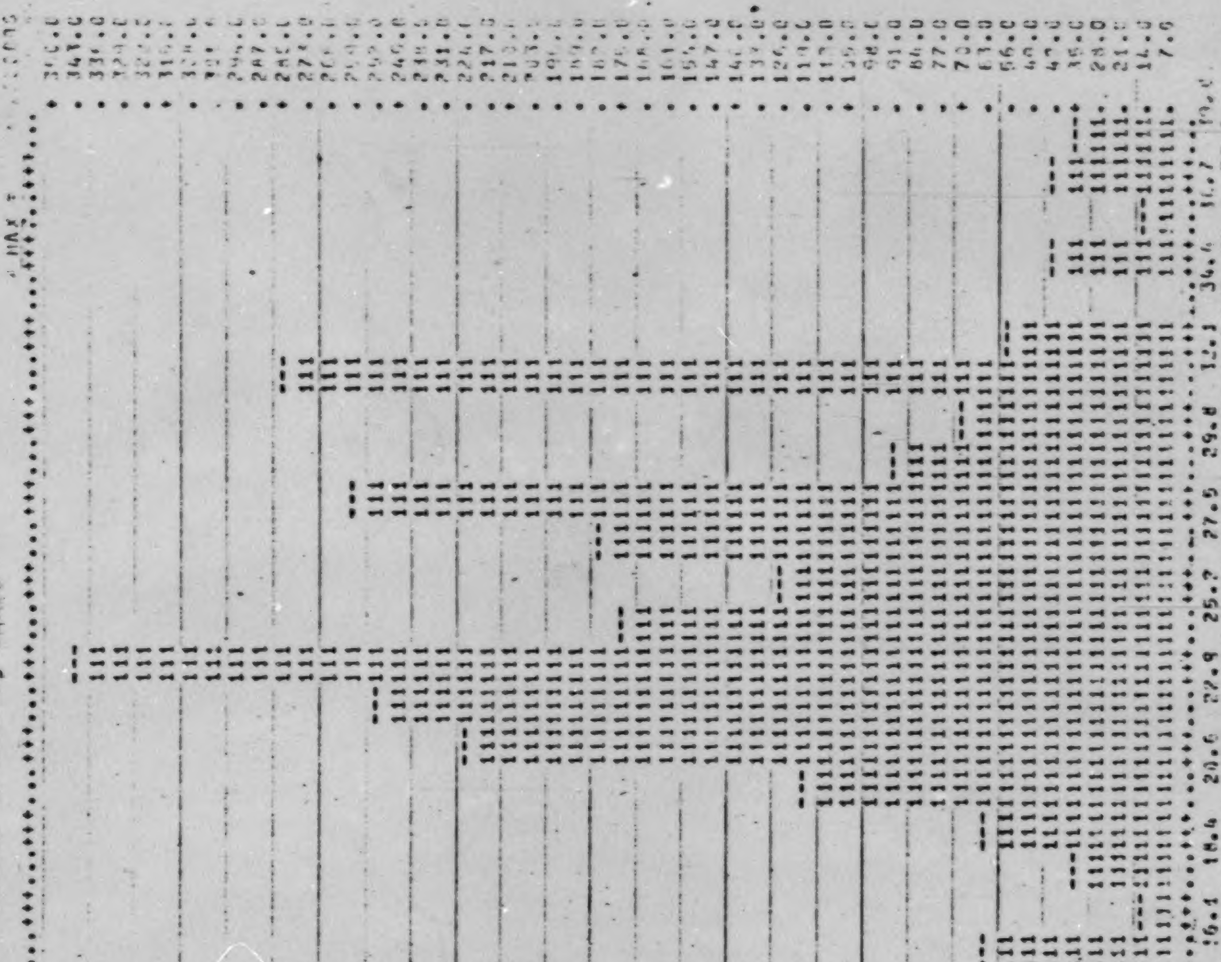


Figure 5.28 Distribution of Number of White Students in Class

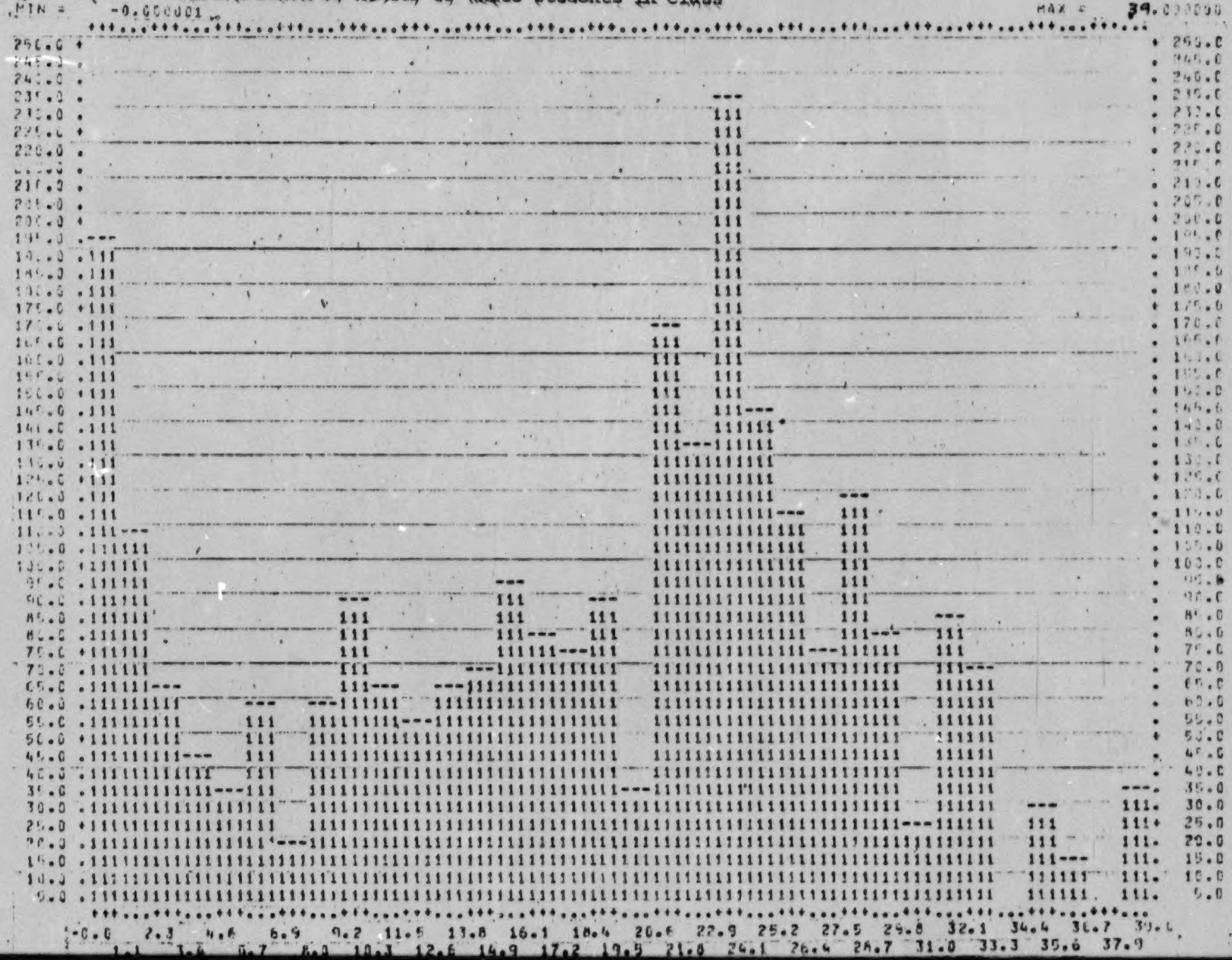


Figure 5.29 Distribution of Number of Black Students in Class

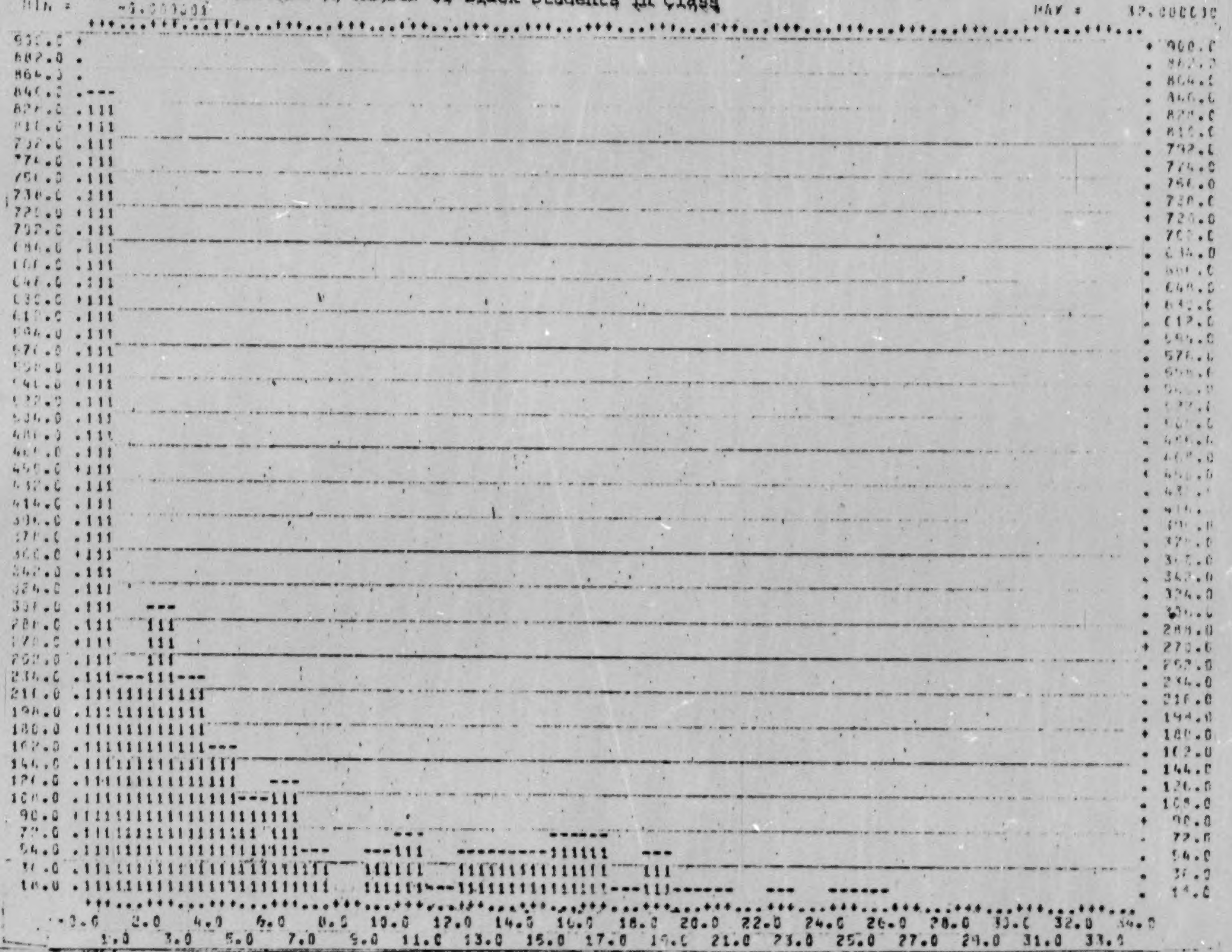


Figure 5.30 Distribution of Number of Oriental Students in Class

```
SPECIAL
 VALUES

  0.000 )*******2528

          TABULATICNS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

  2.000 )
  1.500 )
  1.000 )********144
  0.500 )
  0.000 )
                                                  (PRINTED INTERVAL DESIGNATIONS ARE
MEAN        1.000                                  LOWER LIMITS OF CLASS INTERVALS)
S DEV       0.000
 N        144.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

          MEAN           1.0000
          S DEV          0.0000
          MAXIMUM        1.0000
          MINIMUM        1.0000
```

Figure 5.31 Distribution of Number of Spanish Students in Class

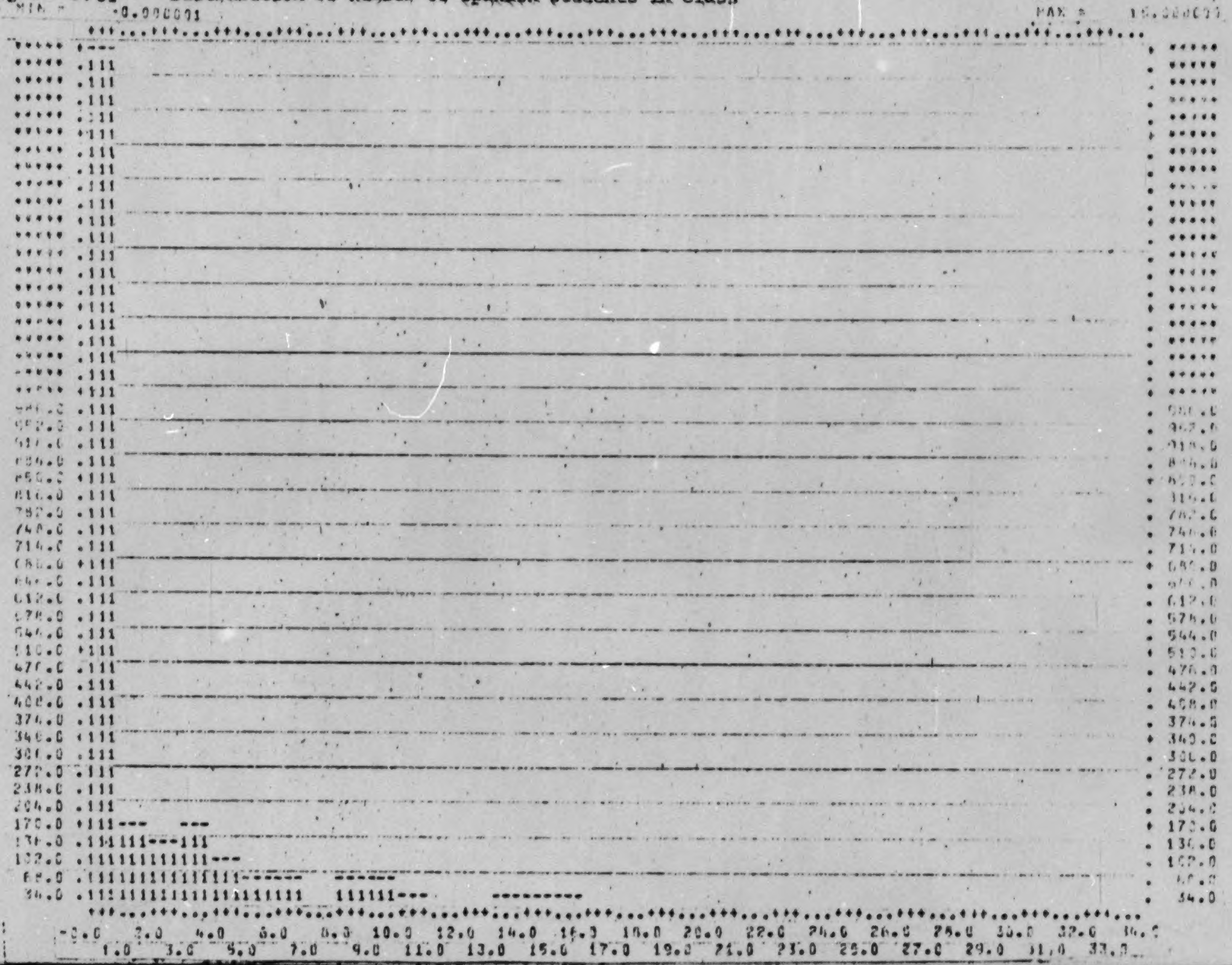


Figure 5. 32 Distribution of Number of American Indian Students in Class

```
 SPECIAL
  VALUES

   0.000 )*******2503

            TABULATICNS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
 INTERVAL

   5.100 )
   4.950 )*********17
   4.800 )
   4.650 )
   4.500 )
   4.350 )
   4.200 )
   4.050 )
   3.900 )
   3.750 )
   3.600 )
   3.450 )                                                   (PRINTED INTERVAL DESIGNATIONS ARE
   3.300 )                                                    LOWER LIMITS OF CLASS INTERVALS)
   3.150 )
   3.000 )*********22
   2.850 )
   2.700 )
   2.550 )
   2.400 )
   2.250 )
   2.100 )
   1.950 )*********37
   1.800 )
   1.650 )
   1.500 )
   1.350 )
   1.200 )
   1.050 )
   0.900 )*********93
   0.750 )

 MEAN      1.882
 S DEV     1.257
  N      169.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

       MEAN         1.8817
       S DEV        1.2574
       MAXIMUM      5.0000
       MINIMUM      1.0000
```

Figure 5.33 Distribution of Number of Working Poor in Classroom

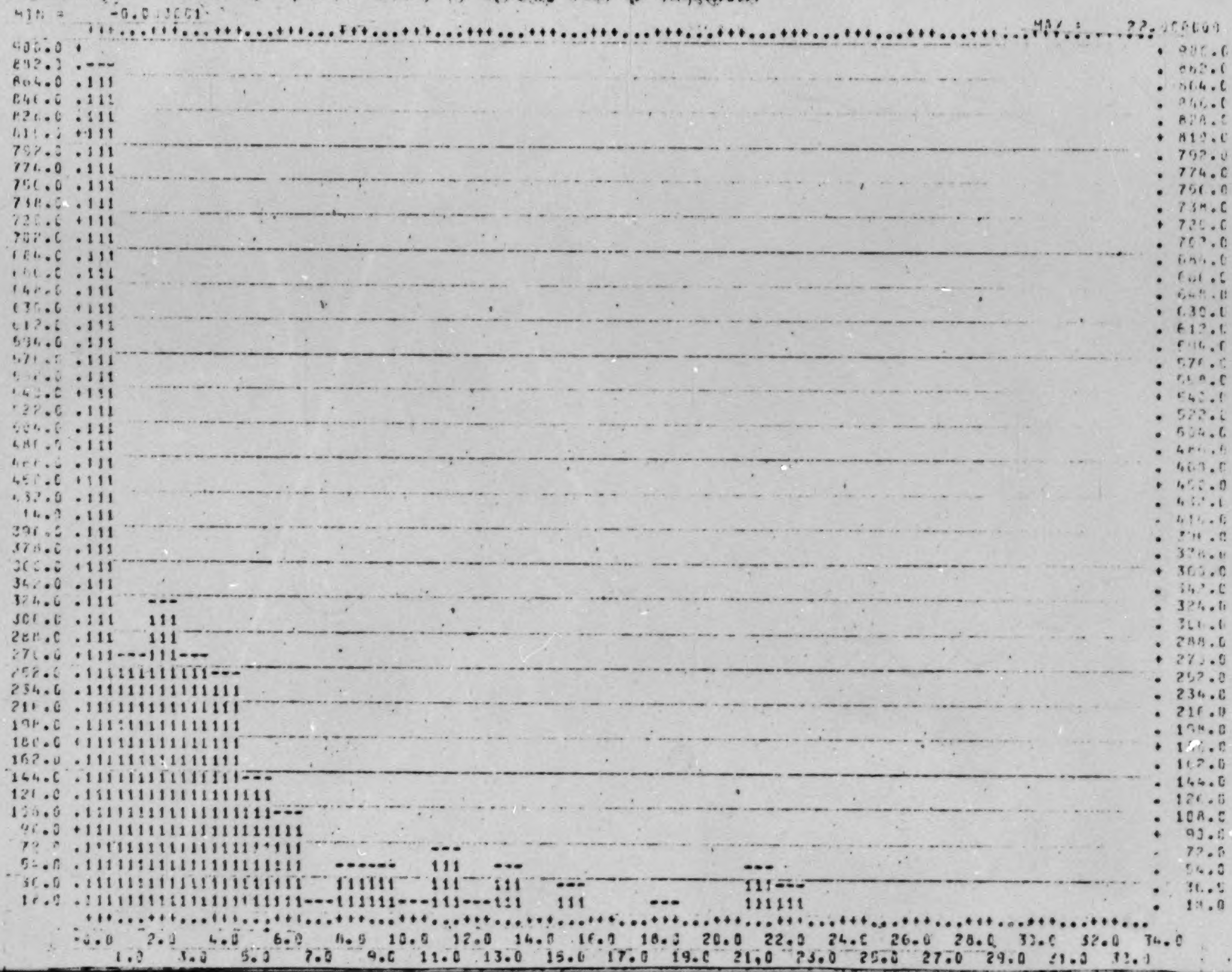


Figure 5.34 Distribution of Number of Unskilled Worker in Classroom

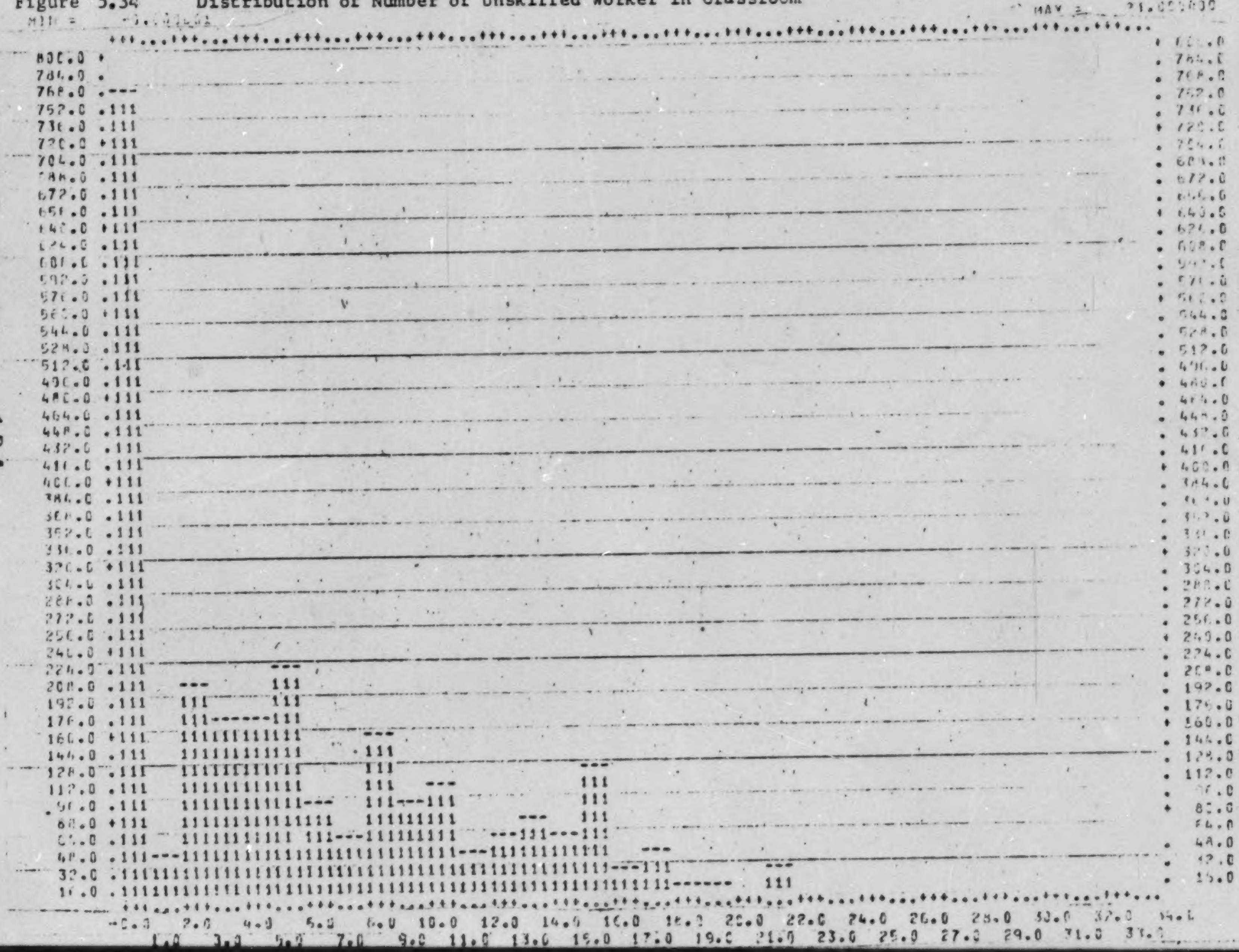


Figure 5.35 Distribution of Number of Skilled Worker, Blue Collar in Classroom

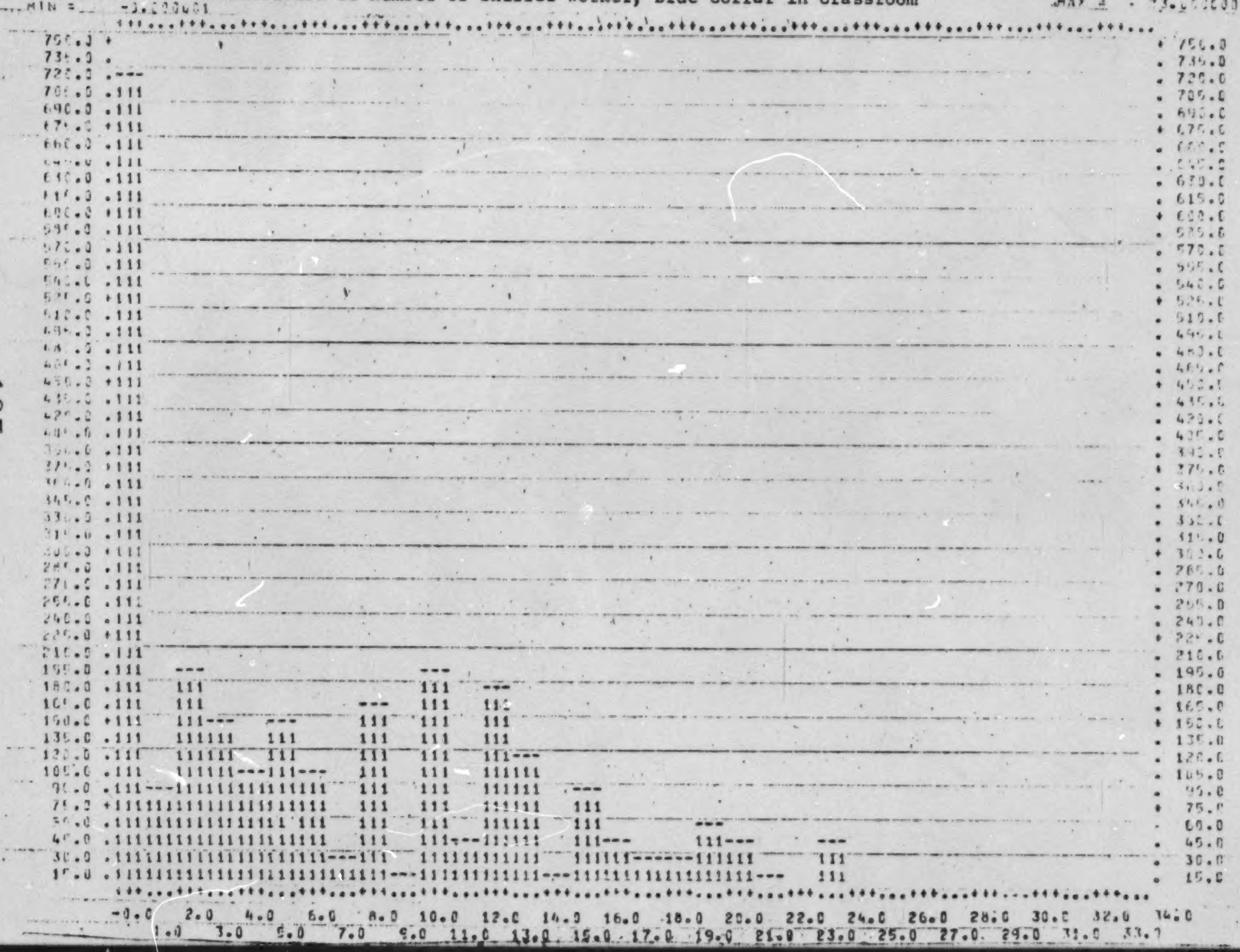


Figure 5.36 Distribution of Number of Skilled Worker-White Collar in Classroom

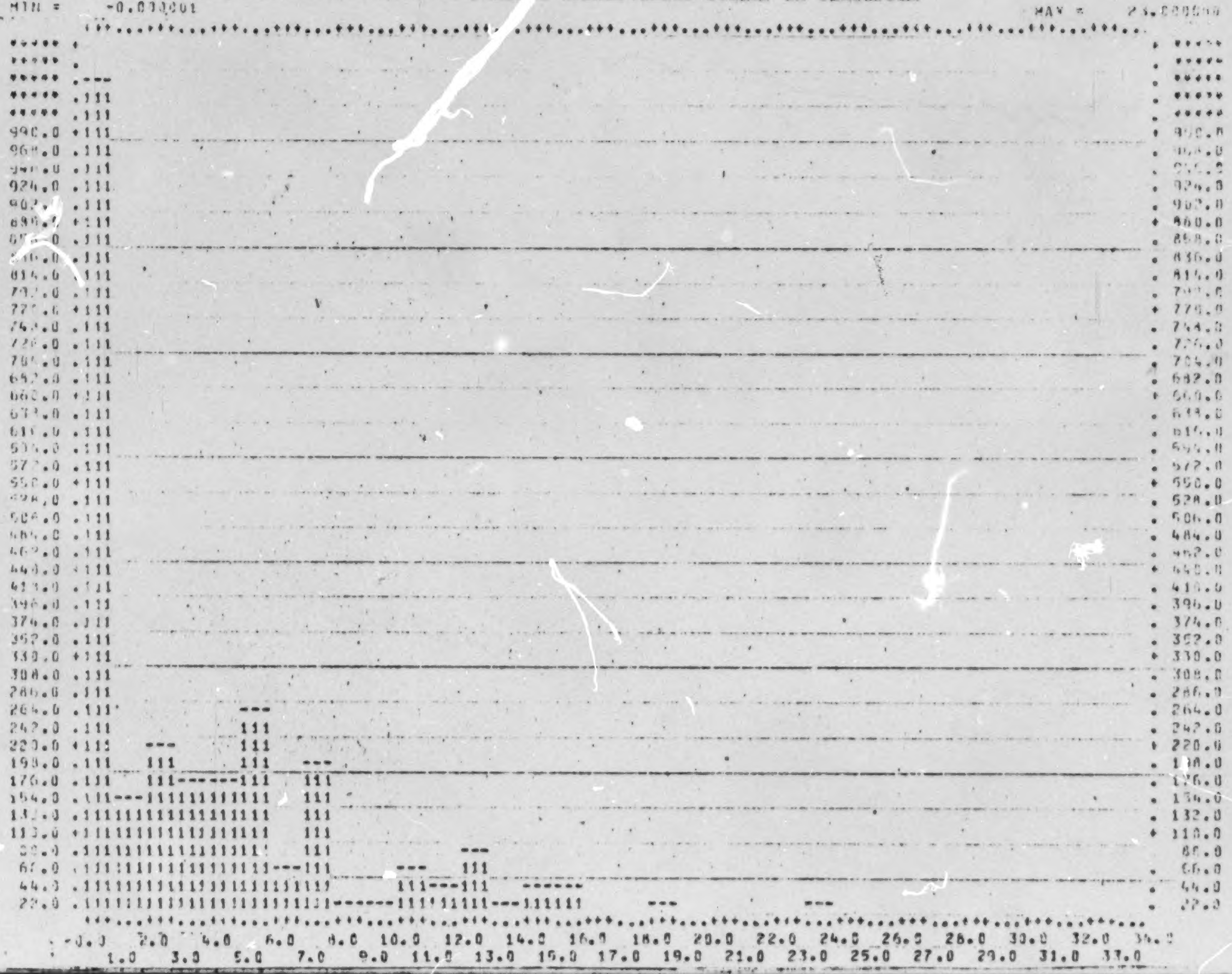


Figure 5.37 Distribution of Number of Business Management in Classroom

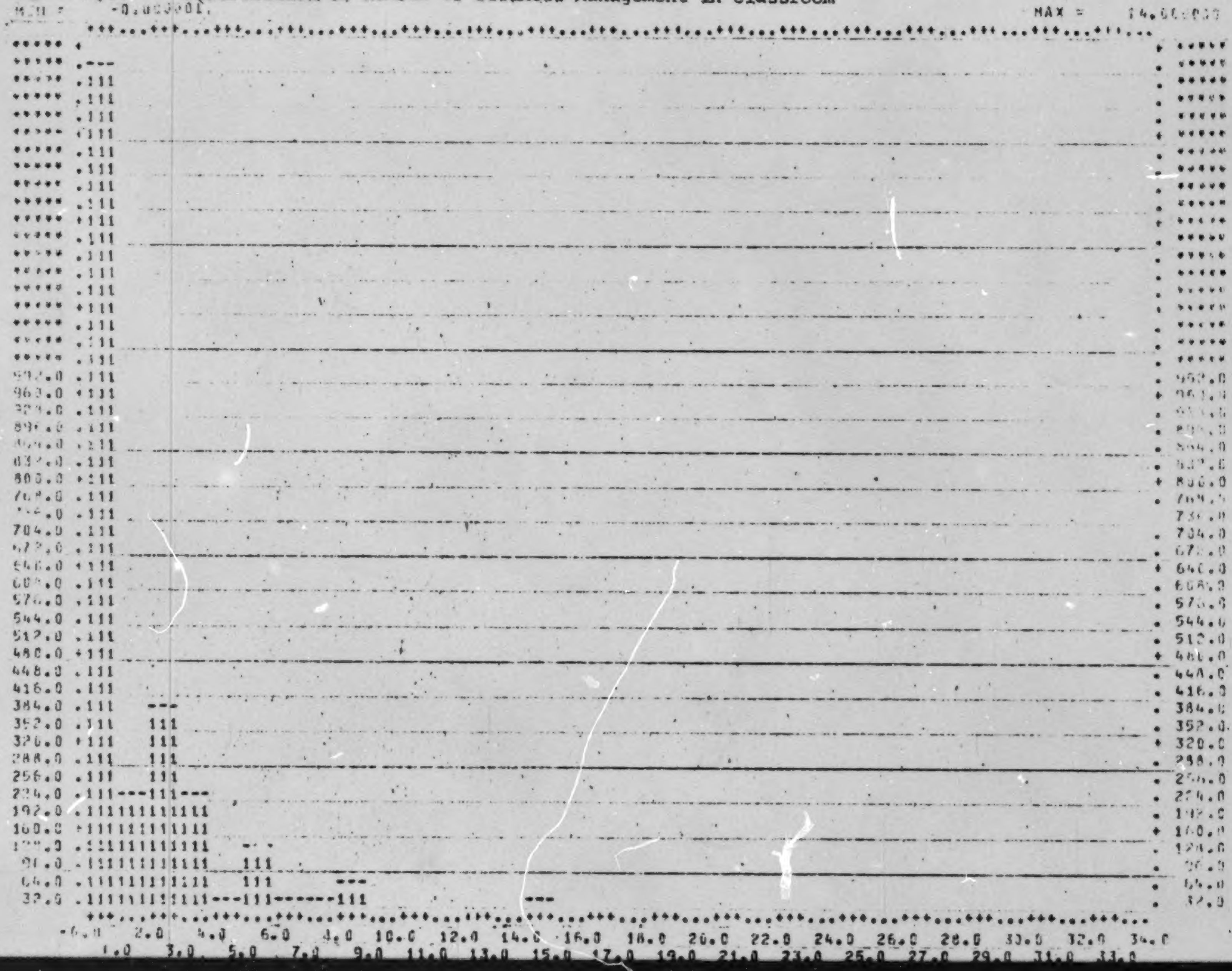


Figure 5. 38 Distribution of Number of Professionals in Classroom

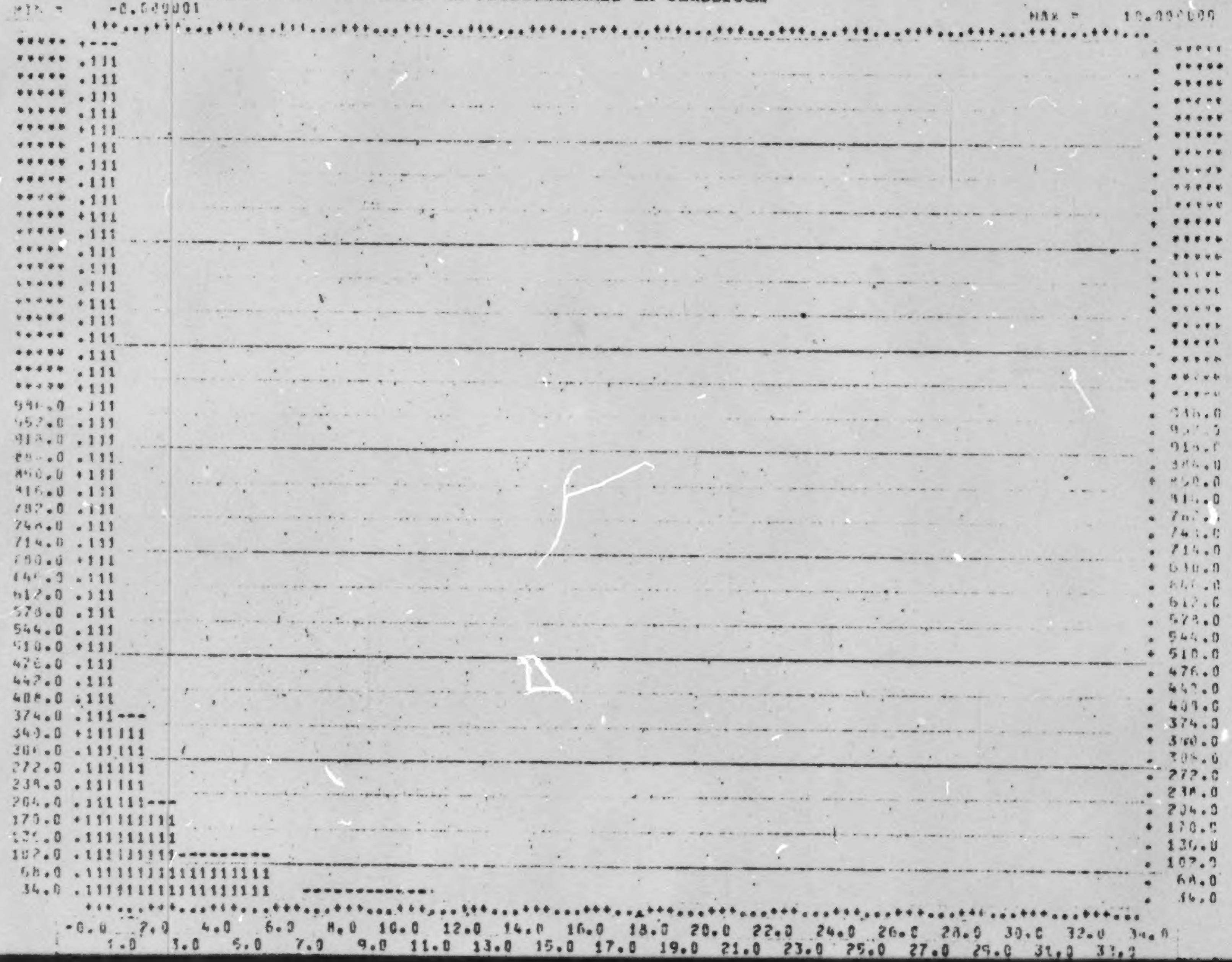


Figure 5.39 Distribution of Classroom Absentee Rate per Day

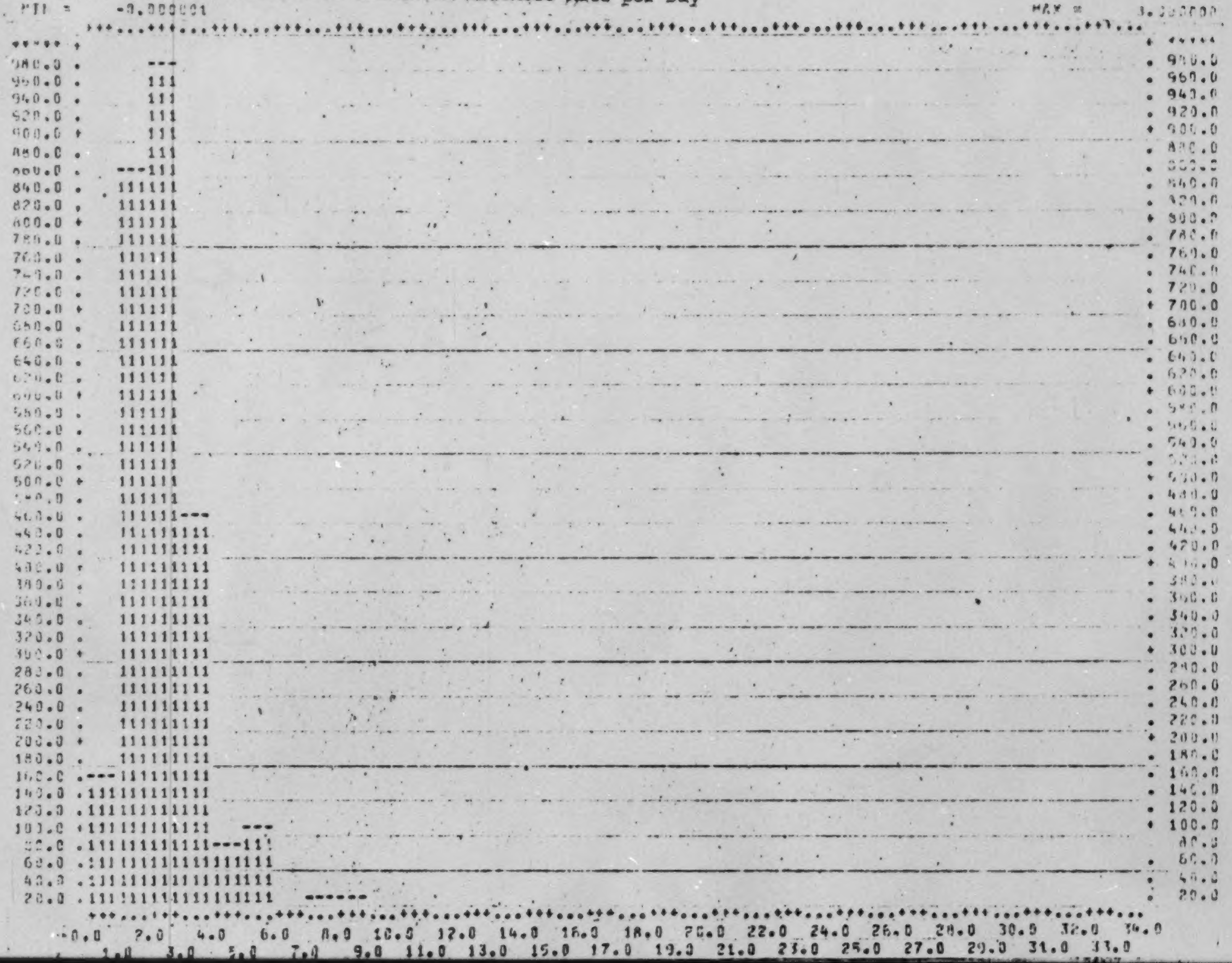


Figure 5.40 Distribution of Student Educational Attainment under Existing Conditions- Teacher Expectancy

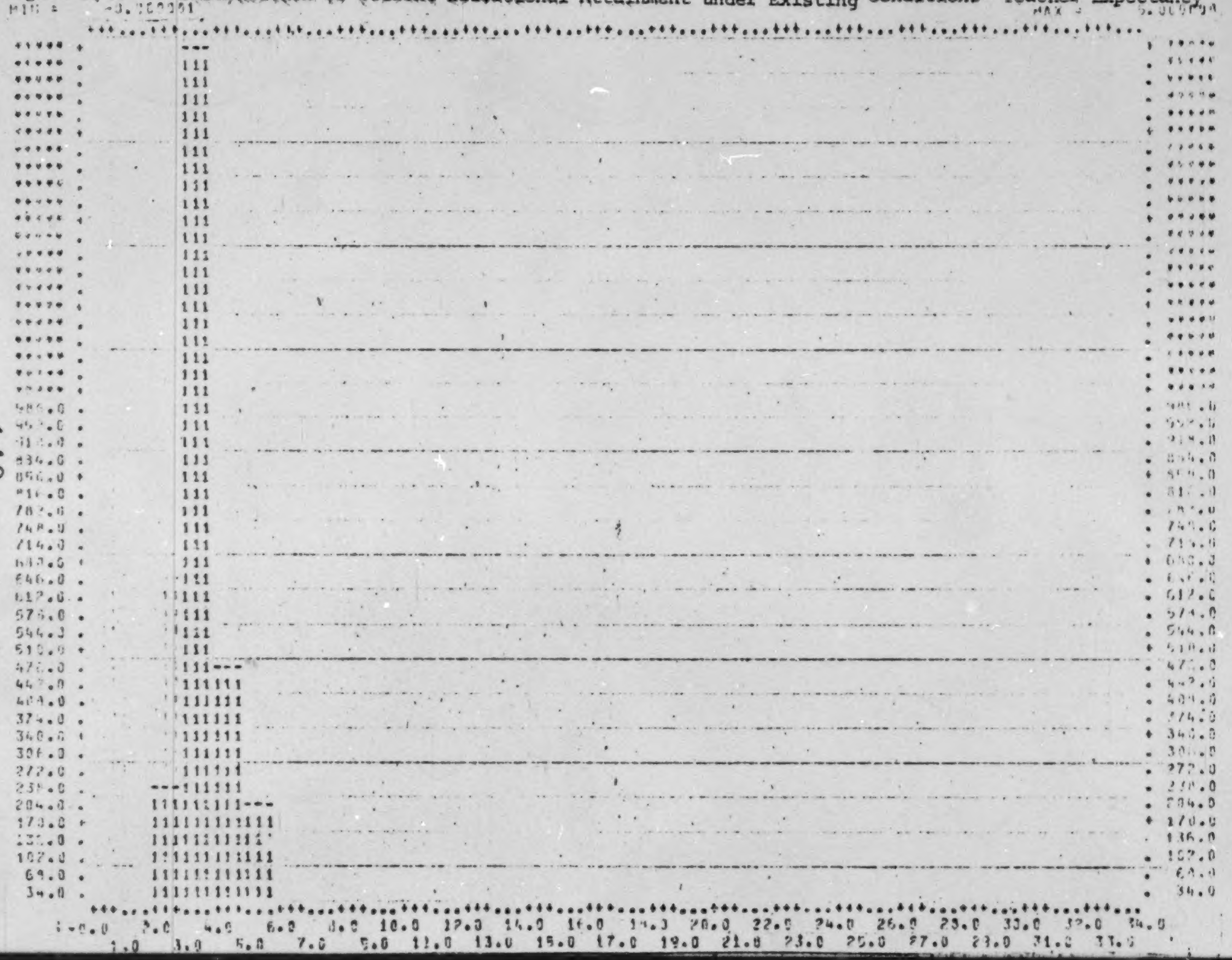


Figure 5.41 Distribution of Student Educational Attainment under Ideal Conditions-Teacher Expectancy

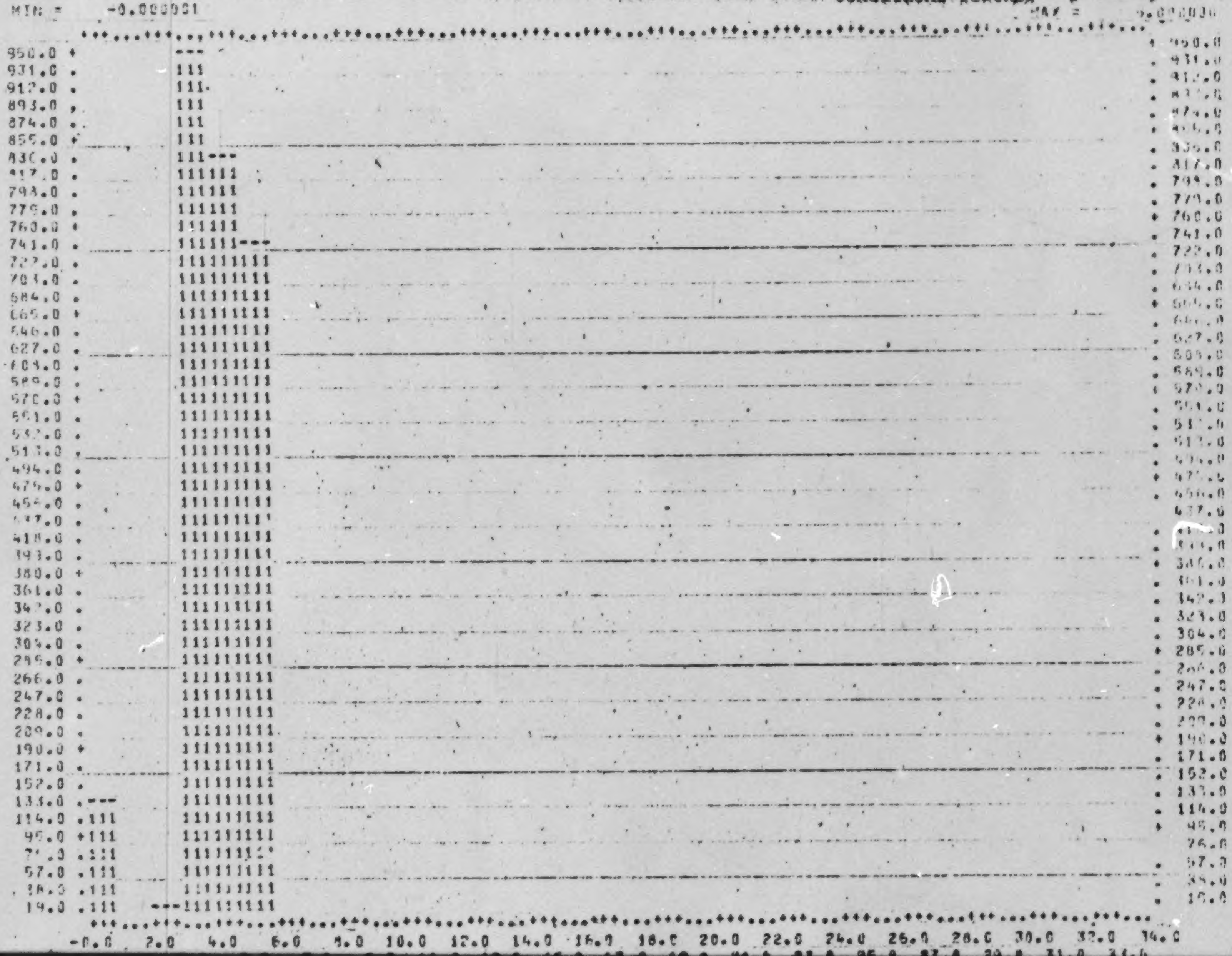


Figure 5.42 Distribution of Number of Undergraduate Courses in Reading Instruction within 5 Years

```
SPECIAL
 VALUES

  0.000 )*******2565

        TABULATICNS AND COMPUTATIONS WHICH FOLLOW EXCLUDE SPECIAL VALUES
INTERVAL

 11.600 )
 11.200 )
 10.800 )*********17
 10.400 )
 10.000 )**
  9.600 )
  9.200 )
  8.800 )
  8.400 )
  8.000 )
  7.600 )
  7.200 )                                                   (PRINTED INTERVAL DESIGNATIONS ARE
  6.800 )                                                    LOWER LIMITS OF CLASS INTERVALS)
  6.400 )
  6.000 )
  5.600 )
  5.200 )
  4.800 )
  4.400 )
  4.000 )
  3.600 )
  3.200 )
  2.800 )*********23
  2.400 )
  2.000 )*********14
  1.600 )
  1.200 )
  0.800 )*********51
  0.400 )
  0.000 )

MEAN        3.318
S DEV       3.625
 N        107.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUCED)

         MEAN          3.3178
         S DEV         3.6254
         MAXIMUM      11.0000
         MINIMUM       1.0000
```

Figure 5.43 Distribution of Number of Graduate Courses in Reading Instruction within 5 Years

```
SPECIAL
 VALUES

  0.000 )********1237

        TABULATICNS AND COMPUTATIONS WHICH FOLLCW EXCLUDE SPECIAL VALUES
INTERVAL

 43.500 )
 42.000 )
 40.500 )
 39.000 )**********30
 37.500 )
 36.000 )
 34.500 )
 33.000 )
 31.500 )
 30.000 )                                              (PRINTED INTERVAL DESIGNATIONS ARE
 28.500 )                                               LOWER LIMITS OF CLASS INTERVALS)
 27.000 )
 25.500 )
 24.000 )
 22.500 )
 21.000 )
 19.500 )
 18.000 )
 16.500 )
 15.000 )
 13.500 )
 12.000 )
 10.500 )
  9.000 )*********53
  7.500 )*********71
  6.000 )*********34
  4.500 )*********68
  3.000 )********335
  1.500 )********543
  0.000 )********301

MEAN       3.736
S DEV     .5.728
N       1435.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED) .

        MEAN          3.7359
        S DEV         5.7281
        MAXIMUM      40.0000
        MINIMUM       1.0000
```

Figure 5.44 Distribution of Number of Hours per Month Inservice Training in Reading Instruction over the Last Two years

```
SPECIAL
 VALUES

  0.000 )********1525

        TABULATICNS AND COMPUTATIONS WHICH FOLLCW EXCLUDE SPECIAL VALUES
INTERVAL


  87.000 )
  84.000 )
  81.000 )
  78.000 )**
  75.000 )
  72.000 )
  69.000 )
  66.000 )
  63.000 )
  60.000 )**********17
  57.000 )
  54.000 )
  51.000 )
  48.000 )                                    (PRINTED INTERVAL DESIGNATIONS ARE
  45.000 )                                     LOWER LIMITS OF CLASS INTERVALS)
  42.000 )
  39.000 )
  36.000 )
  33.000 )
  30.000 )**********33
  27.000 )
  24.000 )**********34
  21.000 )**********43
  18.000 )*********126
  15.000 )**********53
  12.000 )**********36
   9.000 )*********112
   6.000 )*********225
   3.000 )*********227
   0.000 )*********239

MEAN       10.289
S DEV      10.318
 N        1147.

ALL GROUPS COMBINED (SPECIAL VALUES EXCLUDED)

         MEAN         10.2886
         S DEV        10.3176
         MAXIMUM      80.0000
         MINIMUM       1.0000
```

Figure 5.45 Distribution of mpy Teacher Preparation for Reading Instruction

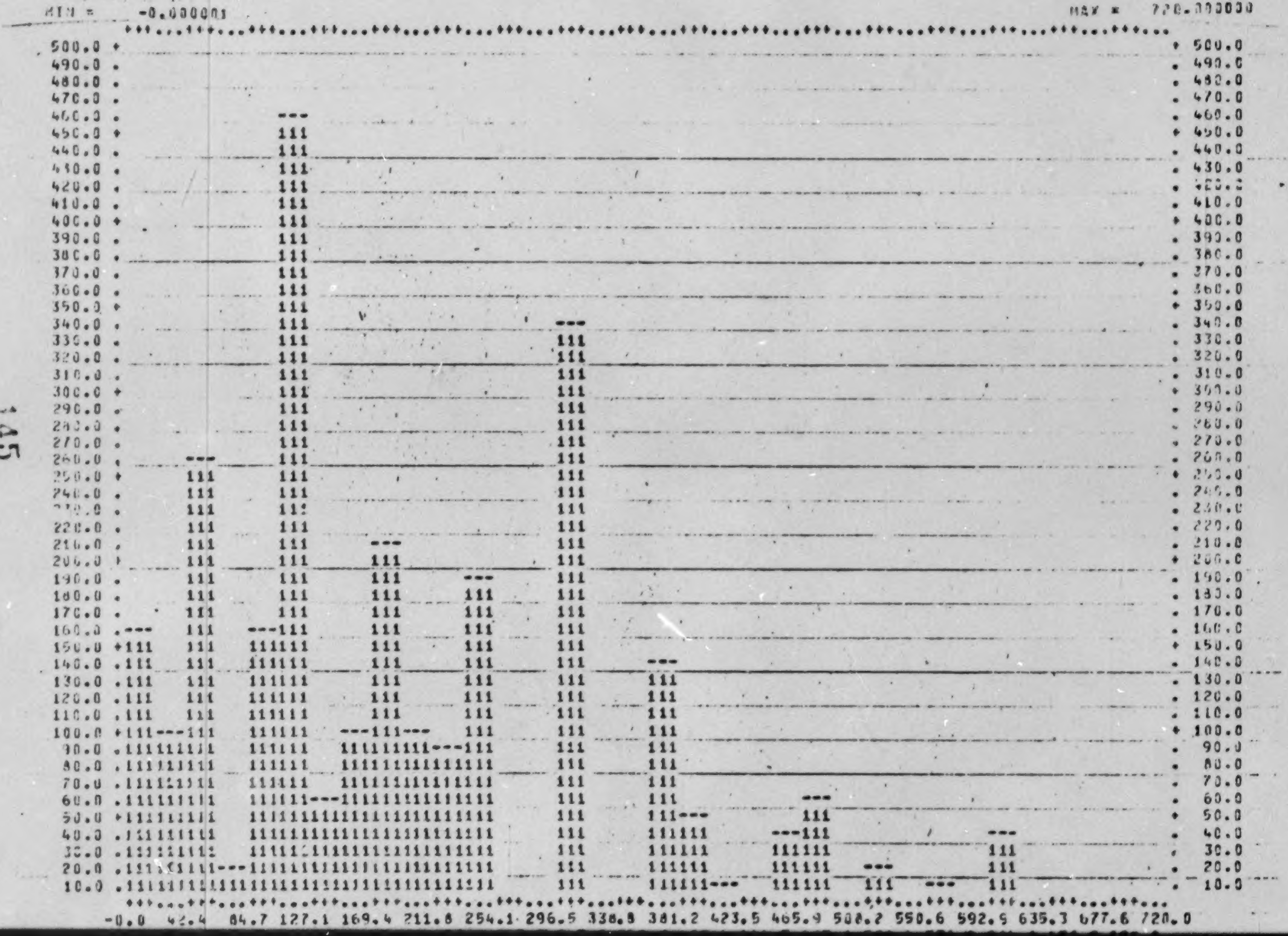


Figure 5.46 Distribution of Teacher Coordination of Reading Instruction

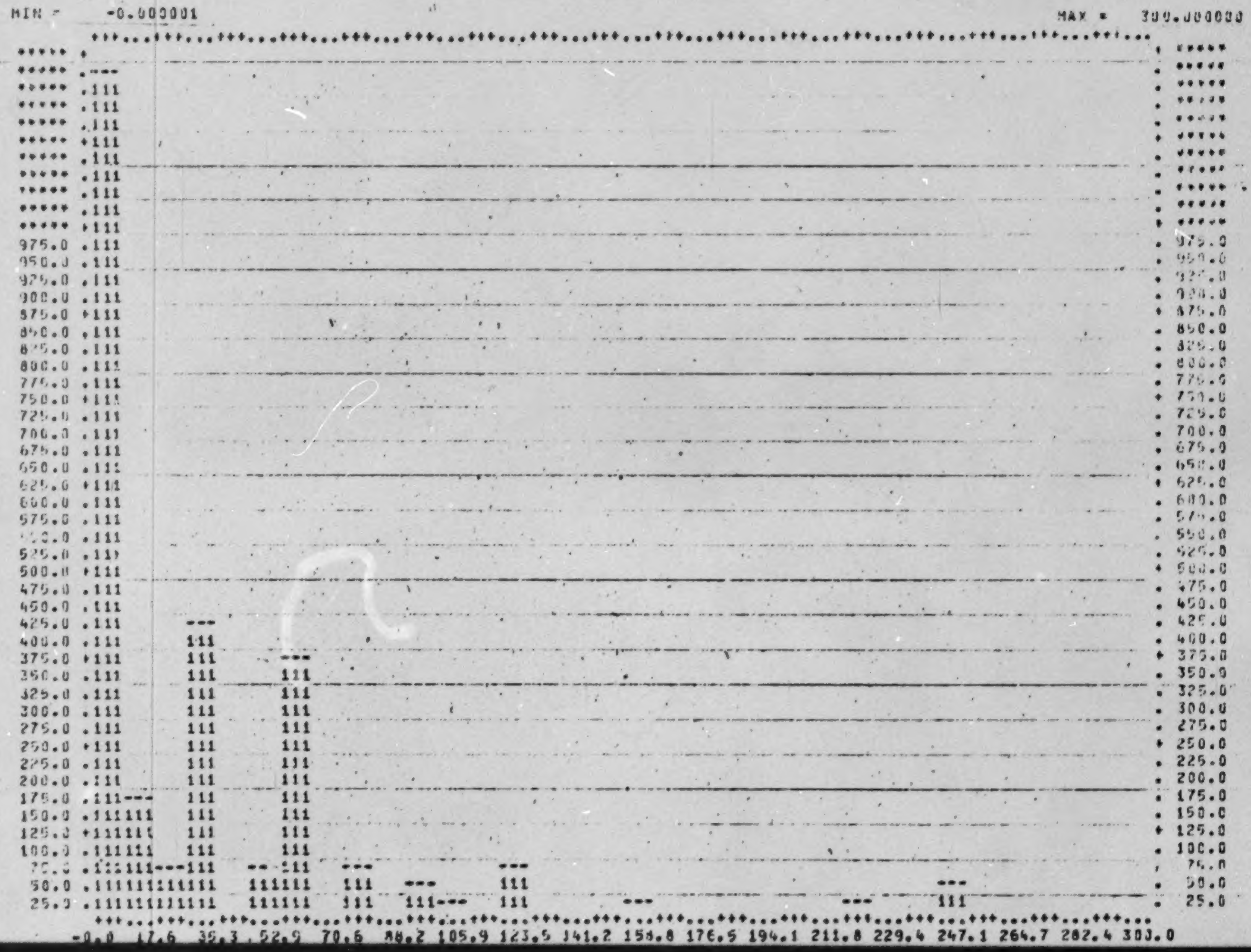


Figure 5.47 Distribution of mpw Non-instructional Reading Activities for Students

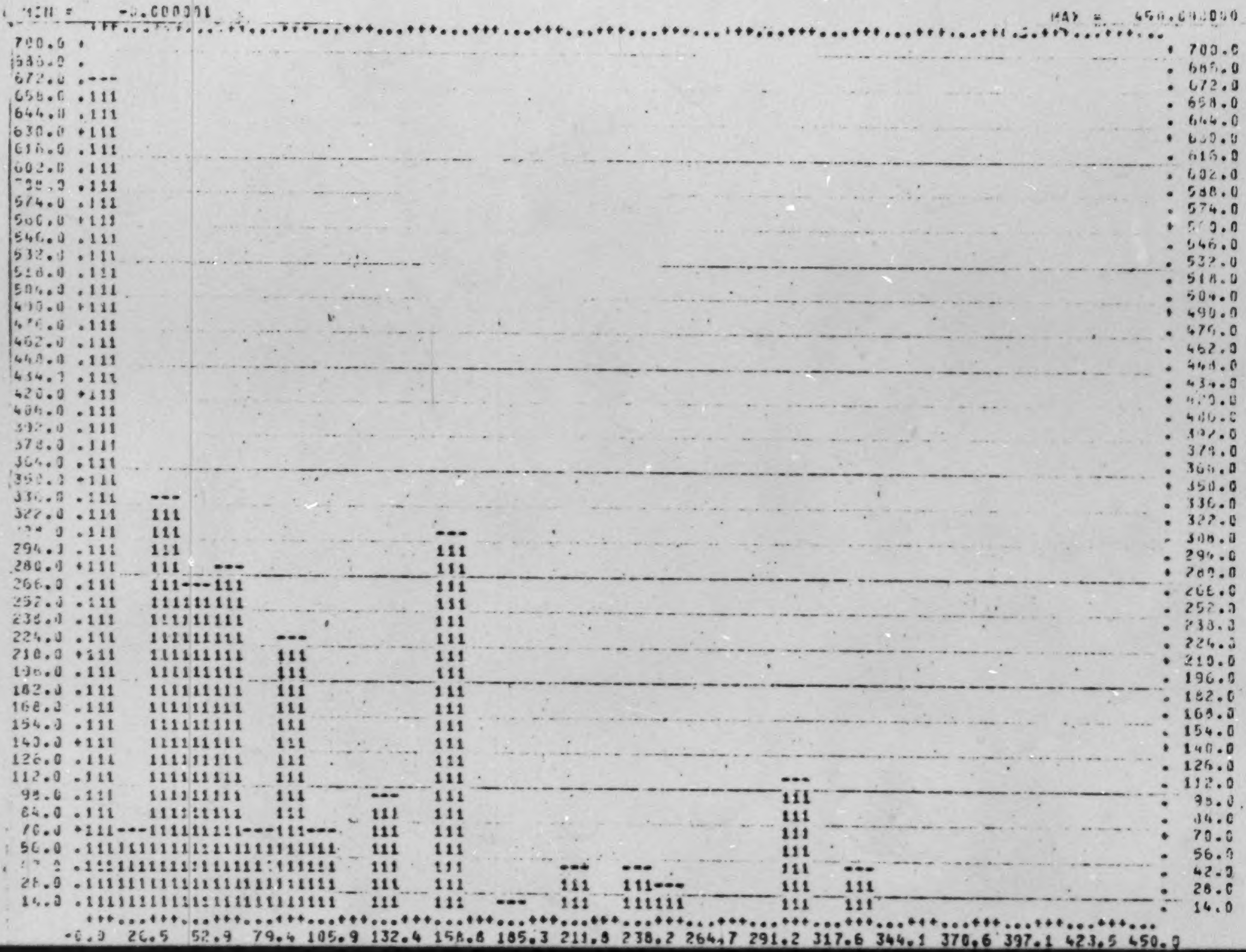


Figure 5.48 Distribution of Teacher Sex (Male=1, Female=2)

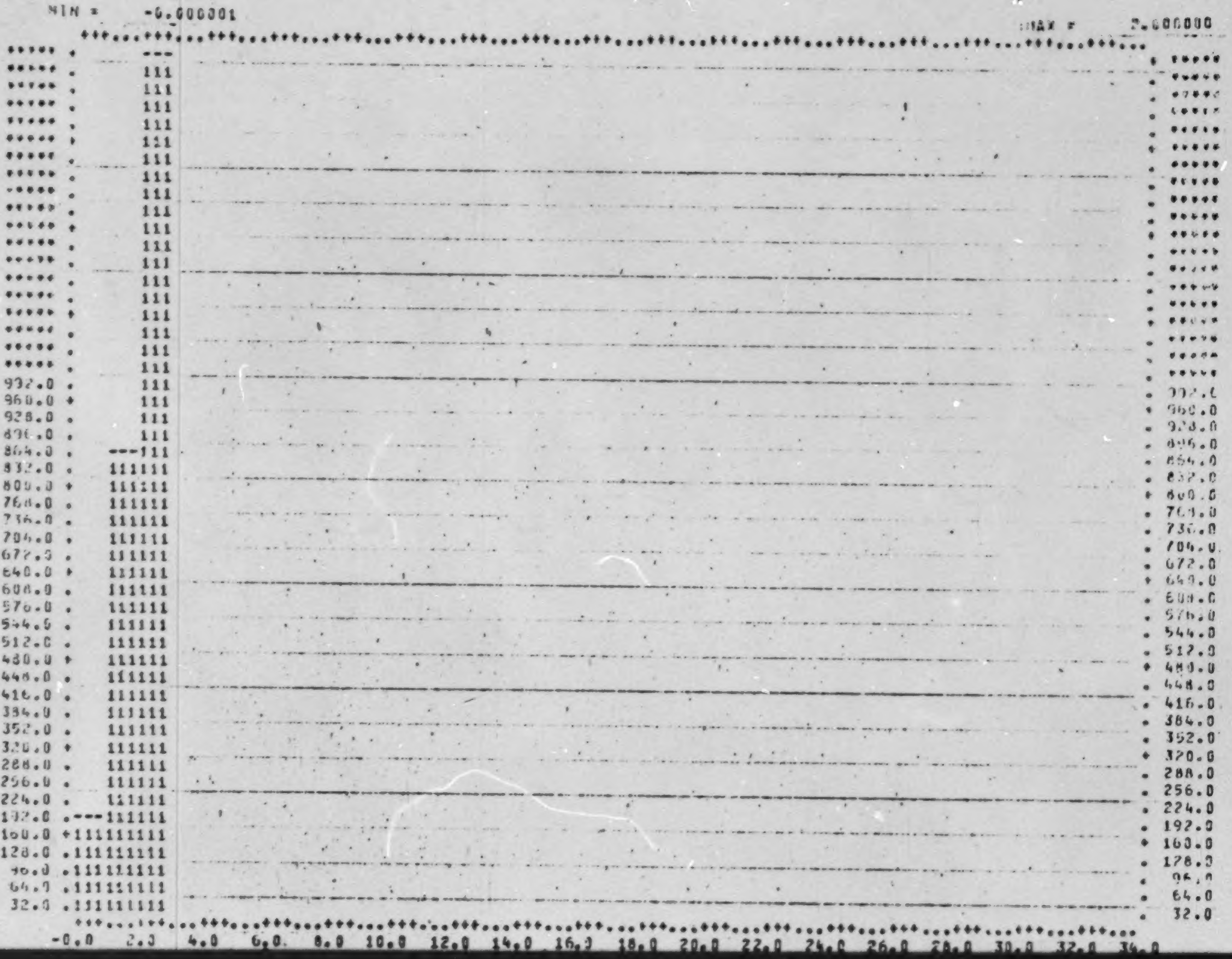


Figure 5.49 Distribution of Teacher Year of Birth

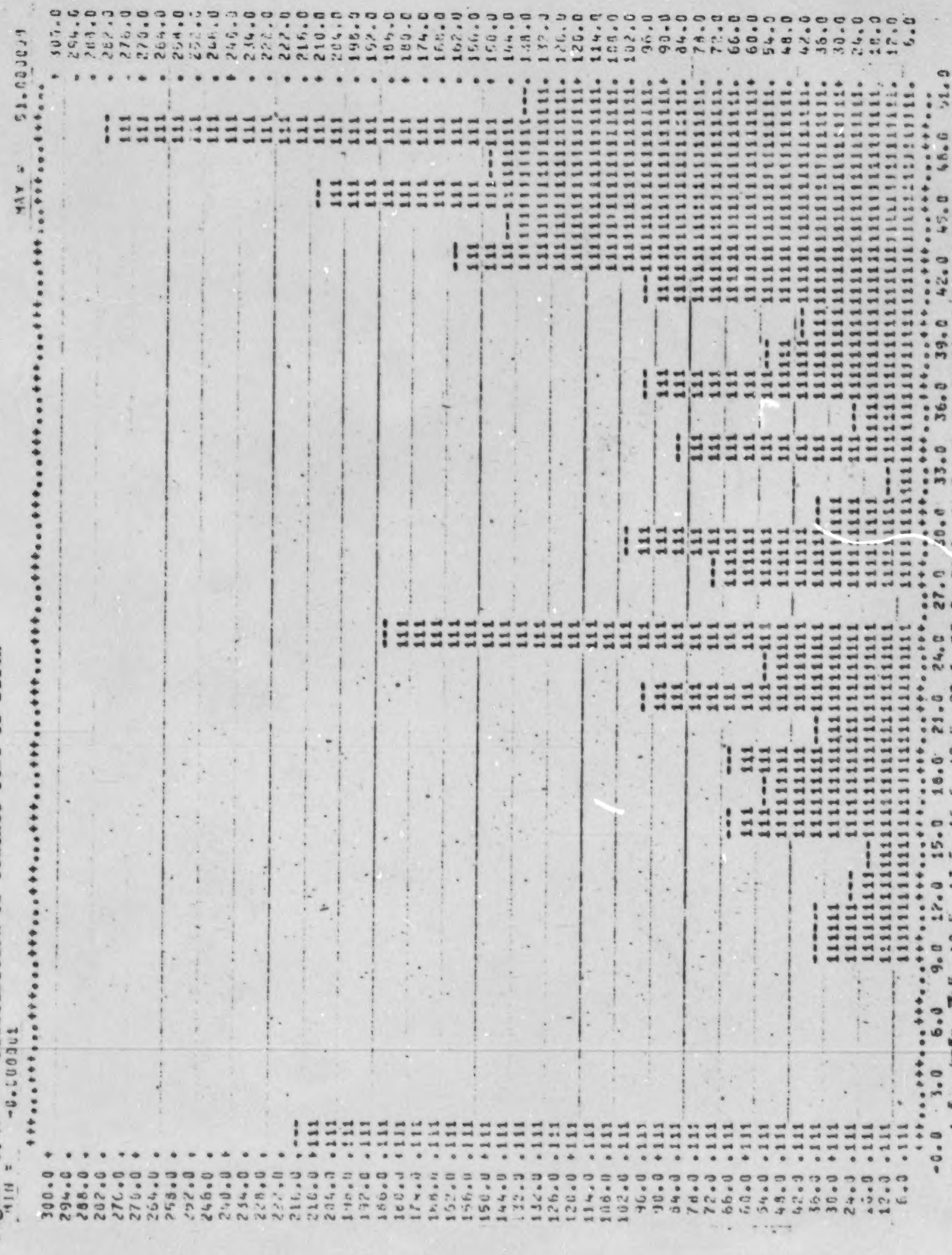


Figure 5.50 Distribution of Teacher Certification Status

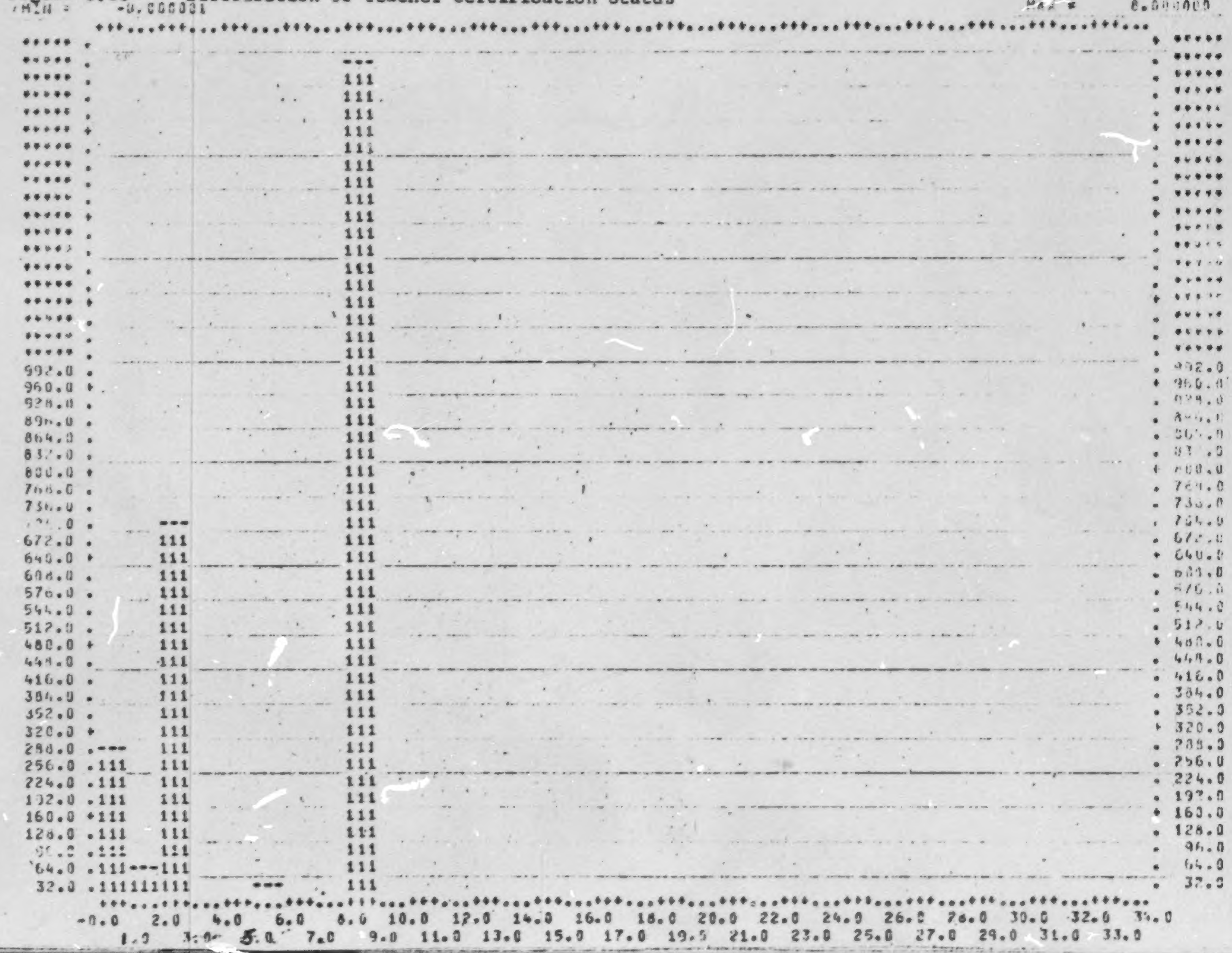


Figure 5.51 Distribution of Teacher Degree Status

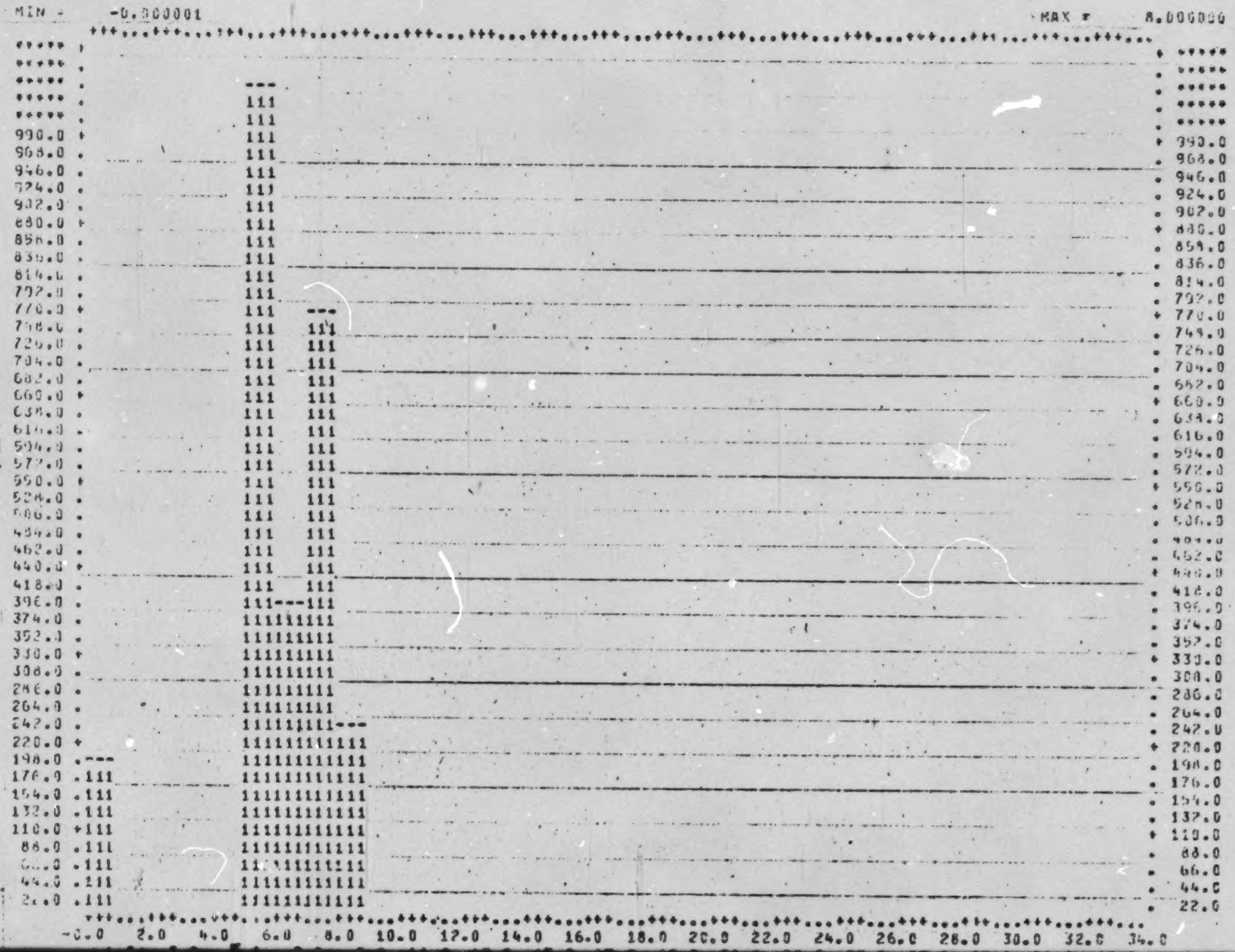


Figure 5.52 Distribution of Total Years Teaching Experience

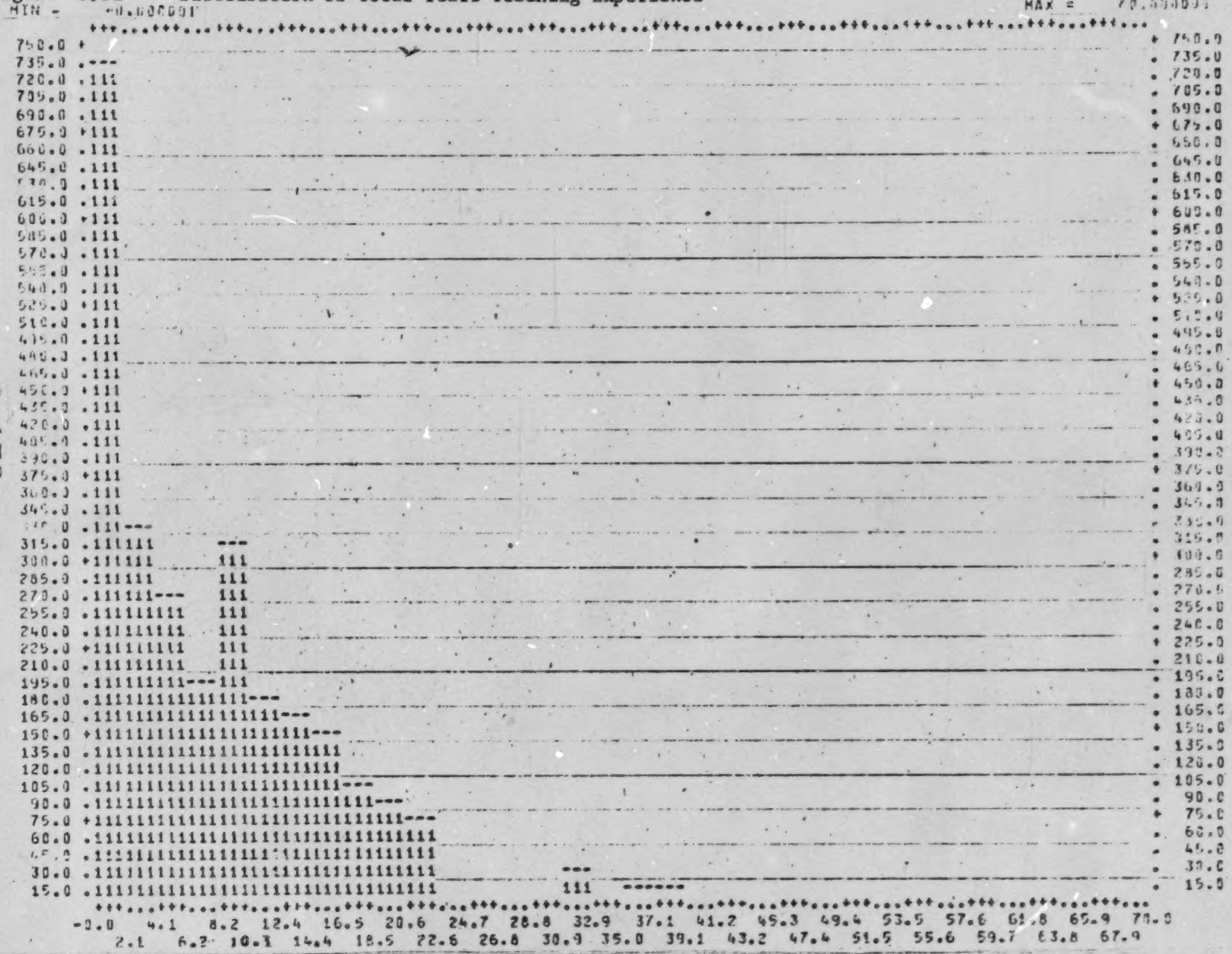


Figure 5.53 Distribution of Type of Teaching Appointment

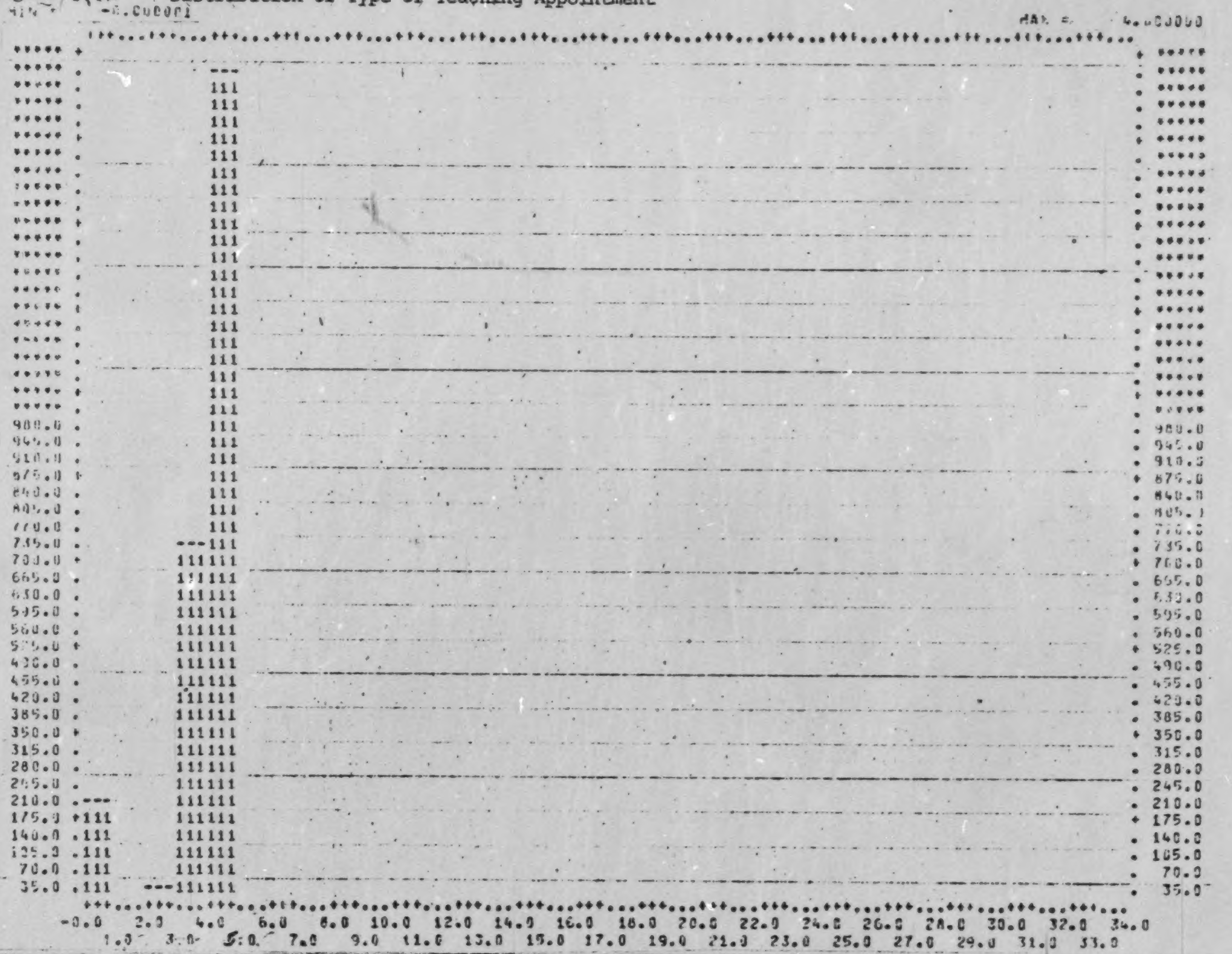


Figure 5.54 Distribution of Index of Materials Resource Utilization

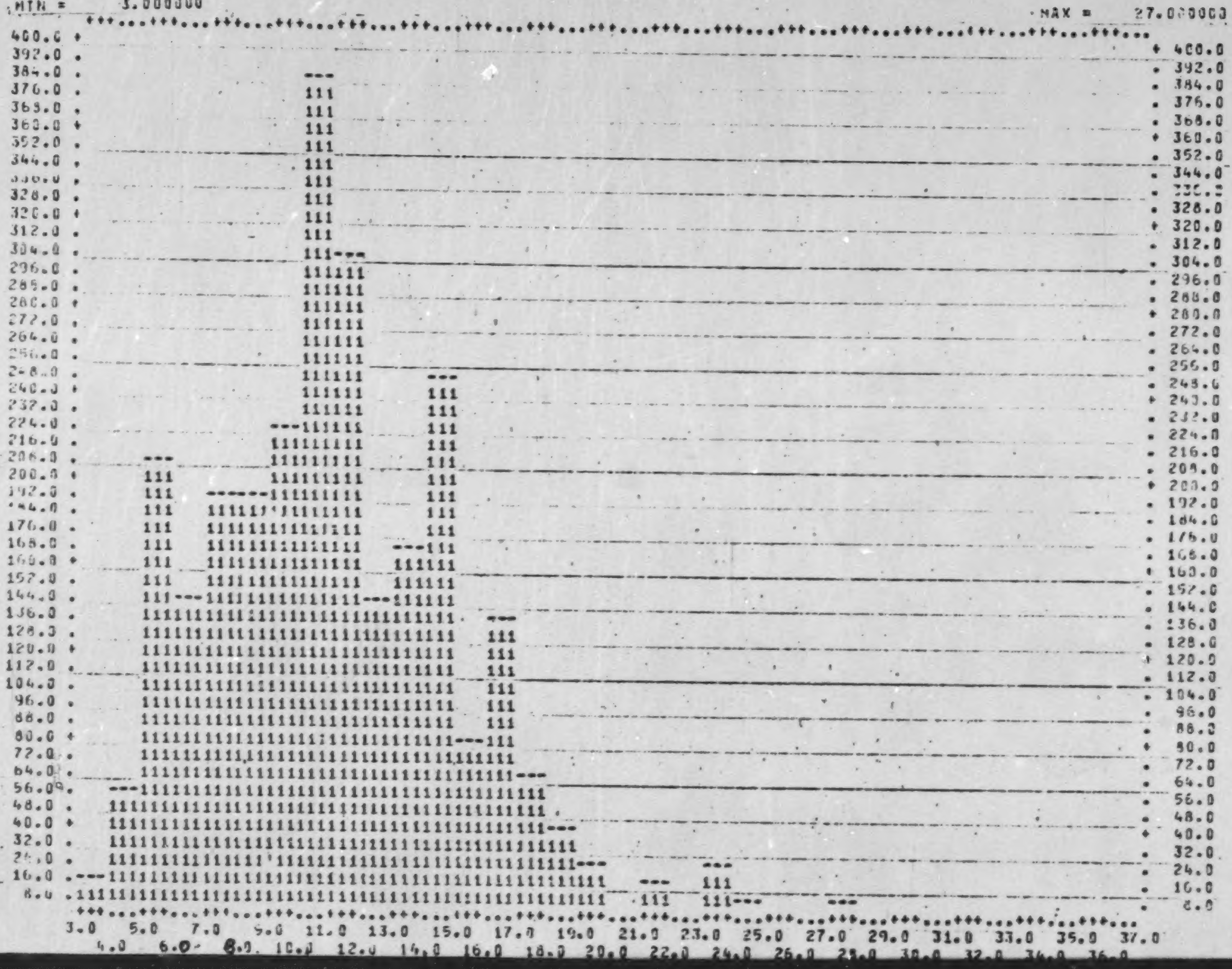


Figure 5.55 Distribution of CAT Reading Pretest Total-ADSS

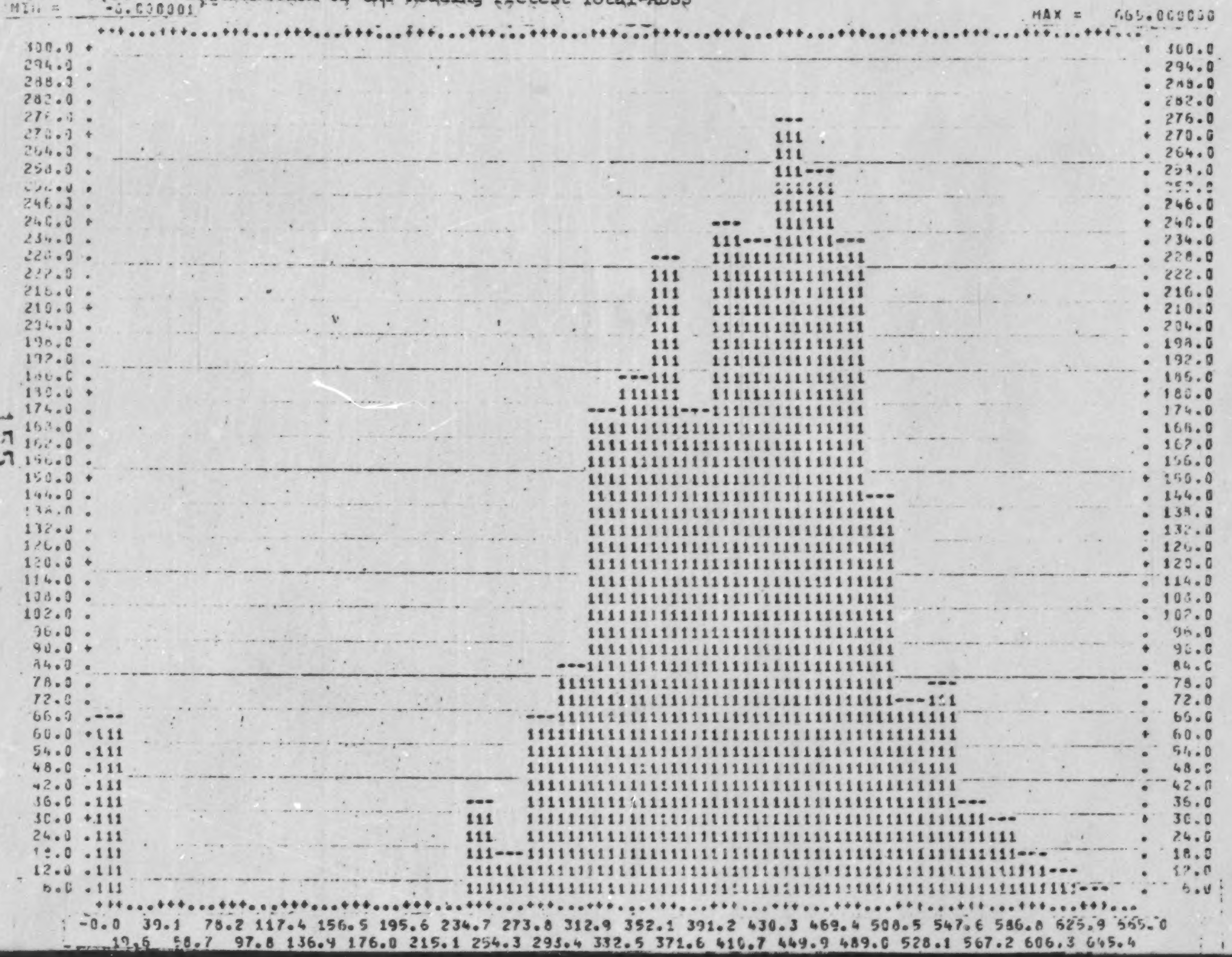
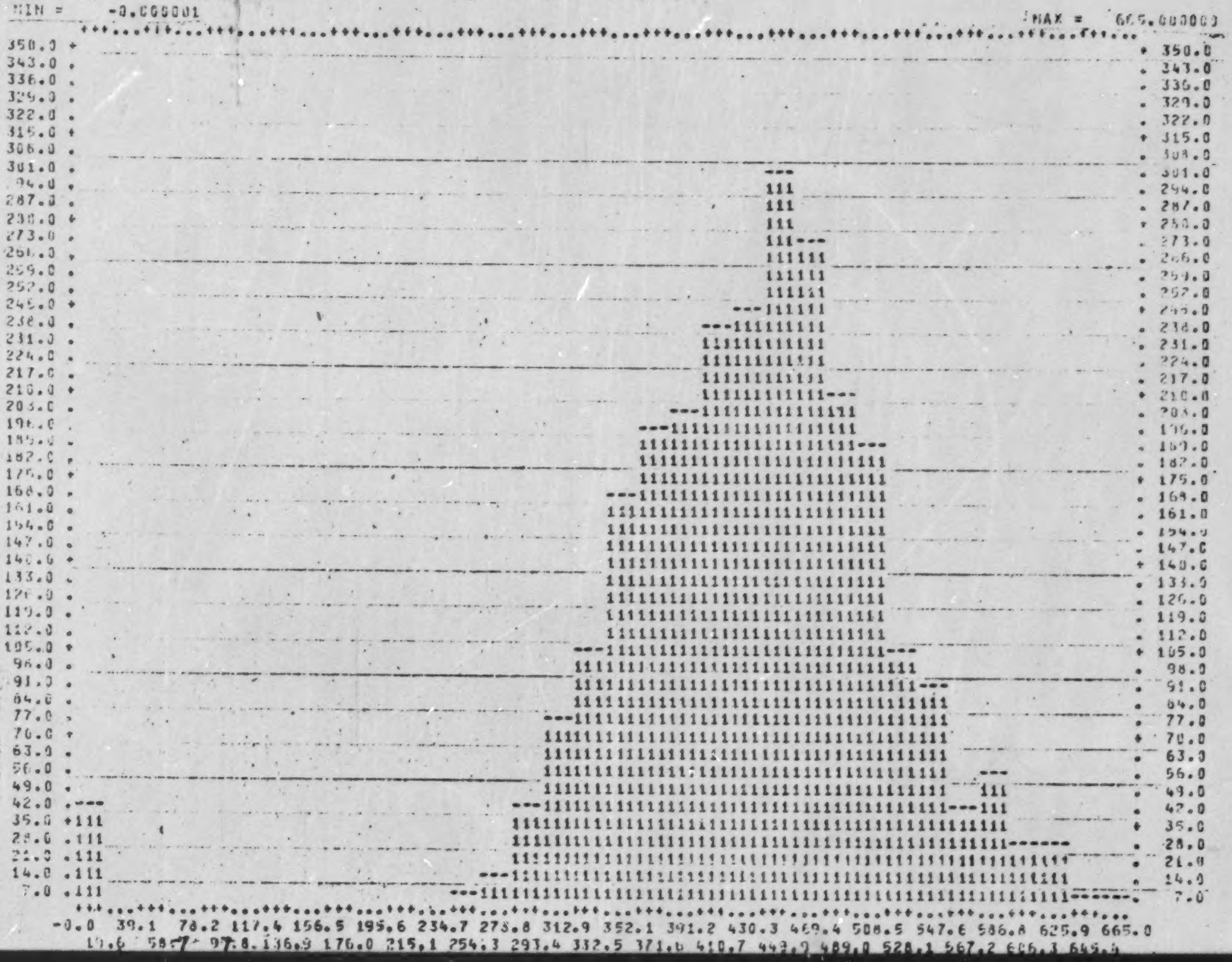


Figure 5.56 Distribution of CAT Reading Post-test Total-ADSS



6.0 Means and Standard Deviations of Major Variables by District

The following table of means and standard deviations included the major variables used in the study. The mean for each variable within each district is given with the standard deviation enclosed in parentheses. Values not available or not applicable to a given district were so designated by a dash (-).

Table 6.1

Means and Standard Deviations of Major Variables by District

Variable Name	DISTRICT A (N=567)	 B (N=947)	 C (N=967)	 D (N=523).
1. Minutes Per Week (MPW) Whole Group Teacher	70.1(83.5)	73.8(118.1)	103.3(136.8)	31.8(46.8)
2. MPW Small Group Teacher	161.9(88.2)	151.7(108.7)	217.1(164.1)	237.6(181.0)
3. MPW Individual Help Teacher	.7(3.0)	2.6(7.7)	3.4(21.5)	4.0(8.3)
4. MPW Individualized Ins. Teacher	--	9.7(39.5)	25.1(101.5)	30.8(87.0)
5. MPW Total Whole Group	70.1(83.5)	73.8(118.1)	103.3(136.8)	31.8(46.8)
6. MPW Total Small Group	163.8(89.0)	163.4(113.2)	236.8(183.5)	242.1(183.5)
7. MPW Total Individual Help	1.8(7.6)	6.8(28.1)	19.4(53.8)	10.6(32.6)
8. MPW Total Individualized Instruction	0.2(5.0)	27.9(67.1)	42.4(119.6)	52.3(103.9)
9. MPW Total Teacher	232.7(76.3)	237.8(122.7)	348.9(146.5)	304.1(156.1)
10. MPW Total Specialist	2.1(13.0)	20.5(49.9)	17.7(66.9)	28.4(75.9)
11. MPW Total Paid Aide	---	12.6(43.0)	32.3(99.8)	6.3(31.1)
12. MPW Total Unpaid Aide	1.1(9.5)	1.0(10.5)	2.9(18.6)	1.0(7.8)
13. MPW Total Reading Instruction	235.9(75.6)	268.7(131.1)	398.8(168.0)	339.8(163.2)
14. CRT, Raw Score, L4, TA1	2.7(5.9)	4.7(8.6)	---	4.4(8.2)
15. CRT, Raw Score, L4, TA4	3.4(5.9)	4.8(8.4)	---	3.7(8.0)

Table 6.1 Continued

16.	CRT, Raw Score, L5, TA1	3.1(5.5)	4.5(9.0)	---	3.5(8.1)
17.	CRT, Raw Score, L5, TA4	3.8(1.7)	4.7(9.4)	---	3.8(8.6)
18.	Student Age in ½ Years	21.8(1.7)	22.2(2.0)	21.8(2.2)	21.6(1.9)
19.	Student Sex	1.5(0.5)	1.5(0.5)	1.5(0.5)	1.5(0.5)
20.	Student Birth Order	7.5(1.6)	1.3(2.9)	6.0(2.9)	8.0(1.5)
21.	Father's Occupation	3.4(1.1)	2.6(2.0)	1.5(1.9)	2.0(1.9)
22.	Fathers Education	3.9(1.4)	0.8(1.8)	2.3(2.3)	0.0(0.3)
23.	Mother's Occupation	6.4(1.5)	4.6(2.8)	2.9(3.2)	3.4(3.4)
24.	Mother's Education	3.7(1.2)	0.8(1.7)	2.6(2.2)	0.0(0.4)
25.	PEP 3rd. Gr. Raw Score	32.9(10.5)	28.1(10.2)	---	30.7(10.1)
26.	No. Days Absent	8.7(6.7)	10.2(9.2)	15.2(14.2)	11.0(9.0)
27.	Percent Days Present	95.6(3.9)	94.7(5.8)	92.0(10.6)	94.1(5.1)
28.	No. Pupils in Class	31.0(4.3)	24.6(4.6)	22.8(4.6)	25.2(4.3)
29.	No. White in Class	27.7(5.5)	20.7(6.9)	10.4(8.2)	15.9(8.7)
30.	No. Black in Class	0.6(0.8)	3.1(3.4)	10.7(6.2)	4.1(3.9)
31.	No. Oriental in Class	0.1(0.2)	0.1(0.3)	0.0(0.1)	---
32.	No. Spanish in Class	2.4(2.0)	0.6(1.5)	0.4(0.8)	4.7(5.4)
33.	No. Indian in Class	0.0(0.1)	0.0(0.0)	1.0(1.5)	---
34.	No. Working Poor in Class	1.9(1.5)	3.3(3.9)	5.7(5.3)	4.3(7.0)
35.	No. Unskilled in Class	6.2(5.1)	5.0(5.1)	7.5(6.6)	5.7(5.8)

Table 6.1 Continued

36.	No. Skilled Blue Collar	13.9(5.0)	4.1(4.7)	2.6(3.2)	7.4(5.2)
37.	No. Skilled White Collar	6.2(4.2)	4.3(5.7)	1.8(3.1)	2.9(2.8)
38.	No. Business	1.8(1.7)	2.5(2.8)	1.6(1.3)	1.9(2.6)
39.	No. Professional	0.6(0.9)	1.3(2.5)	1.6(3.9)	1.2(1.7)
40.	No. Absences Per Day	2.1(1.0)	2.1(1.3)	2.6(1.4)	1.7(0.9)
41.	Teacher Real Expectancy	3.3(0.6)	3.3(0.8)	3.0(0.9)	3.3(0.6)
42.	Teacher Ideal Expectancy	3.8(0.9)	3.9(0.8)	3.8(0.8)	4.0(0.7)
43.	No. Undergrad. Courses	---	0.2(1.4)	0.1(0.6)	0.2(0.6)
44.	No. Grad. Courses	3.4(8.9)	0.9(1.6)	2.3(2.4)	1.9(2.7)
45.	No. Hours Per Month Inservice	4.4(7.3)	3.4(5.3)	8.6(14.9)	2.8(7.3)
46.	MPW Preparation Time	147.2(95.0)	181.1(133.5)	291.6(206.1)	238.3(124.6)
47.	MPW Coordination Time	32.7(62.2)	41.6(54.0)	42.7(48.3)	39.3(31.6)
48.	MPW Non-Instruc. Reading Activity	86.0(84.2)	91.4(96.3)	87.9(90.1)	92.0(103.0)
49.	Teacher Sex	1.5(0.5)	1.6(0.5)	1.6(0.5)	2.0(0.0)
50.	Teacher Certification	6.6(3.0)	6.2(2.8)	5.0 3.2)	3.8(3.5)
51.	Teacher Degree Status	6.8(0.8)	6.0(1.1)	5.9(1.0)	5.5(0.7)
52.	Teacher Years Experience	11.4(4.6)	11.2(8.1)	5.1(4.6)	9.0(4.2)
53.	Teacher Type Appointment	4.0(0.2)	3.8(0.5)	3.4(0.5)	3.7(0.4)
54.	IWRU	9.1(3.1)	11.3(4.2)	11.8(4.3)	10.9(3.3)

Table 6.1 Continued

55.	ADSS-CAT Pretest Total	441.9(63.1)	430.2(70.4)	372.8(68.3)	409.4(77.8)
56.	ADSS-CAT Post-Test Total	461.7(64.2)	440.4(72.0)	398.5(74.5)	422.5(74.8)
57.	ADSS-CAT Pre-Pretest Comp.	316.1(218.3)	388.3(145.1)	---	---
58.	Minutes Per Year (MPY) Whole Group Teacher	2443.2(2924.7)	2437.7(3995.6)	3457.9(4597.8)	1076.5(1593.1)
59.	MPY Small Group Teacher	5600.9(3083.6)	5088.3(3764.3)	7225.6(5529.6)	7878.7(6162.5)
60.	MPY Individual Help Teacher	23.1(93.7)	86.6(255.0)	124.4(749.4)	136.5(290.0)
61.	MPY Individualized Ins. Teacher	---	327.4(1351.3)	863.5(3452.5)	1067.5(3020.6)
62.	MPY Total Whole Group	2443.2(2924.7)	2437.7(3995.6)	3457.9(4597.8)	1076.5(1593.1)
63.	MPY Total Small Group	5664.1(3106.8)	5489.1(3931.6)	7882.8(6176.5)	8020.7(6252.0)
64.	MPY Total Individual Help	62.3(261.3)	228.7(971.2)	658.7(1812.0)	361.2(1135.4)
65.	MPY Total Individ. Instruc.	7.3(174.1)	946.1(2307.6)	1436.8(4048.3)	1871.0(3545.9)
66..	MPY Total Teacher	8067.1(2716.9)	7940.0(4398.2)	11,641.5(5032.7)	10,159.3(5408.9)
67.	MPY Total Specialist	74.4(452.7)	698.4(1715.7)	596.1(2224.1)	933.9(2509.2)
68.	MPY Total Paid Aide	---	429.5(1470.4)	1087.9(3389.6)	211.2(1083.3)
69.	MPY Total Unpaid Aide	35.3(315.1)	33.8(369.7)	110.7(637.8)	35.0(260.3)
70.	MPY Total Reading Instruc.	8176.9(2690.9)	8999.9(4777.8)	13,296.8(5743.9)	11,339.5(5628.8)
71.	Ideal-Real Teacher Expec.	0.6(0.7)	0.6(0.6)	0.7(--)	0.7(0.8)
72.	Teacher's Age	43.5(9.6)	39.6(12.1)	31.3(9.5)	37.2(9.8)
73.	% White in Class	89.0(8.7)	83.0(18.2)	41.5(29.5)	63.9(32.7)
74.	% Black in Class	2.0(2.5)	13.2(14.8)	---	17.2(18.5)

Table 6.1 Continued

75.	% Oriental in Class	0.2(0.8)	0.4(1.2)	---	---
76.	% Spanish in Class	8.0(7.0)	2.7(7.3)	---	17.4(20.4)
77.	% Indian in Class	0.1(0.5)	0.0(0.0)	---	---
78.	% Working Poor in Class	6.4(5.2)	14.7(18.0)	26.5(25.2)	15.8(24.7)
79.	% Unskilled in Class	19.5(15.4)	22.6(23.7)	32.2(27.4)	22.3(22.7)
80.	% Blue Collar in Class	44.6(16.5)	16.4(18.0)	---	30.0(22.8)
81.	% White Collar in Class	20.4(14.6)	16.4(20.6)	---	11.1(10.8)
82.	% Business in Class	5.6(5.6)	5.6(9.6)	---	7.3(9.7)
83.	% Professional in Class	2.0(3.2)	4.8(9.4)	---	4.9(6.8)

7.0 Intercorrelations of Major Variables by District

The intercorrelations of the variables used in the full model regression analysis for each district are presented in Tables 7.1 - 7.4. It should be noted that for *df* = 500, *r* must be at least ± .088 to be significant at the .05 level and ± .115 at the .01 level. The variable numbers correspond to the variables used in the regression analysis for each respective district. Therefore the numbers are not consecutive.

Table 7.1 Intercorrelations of Variables Used in the Regression Analysis-District A

Variables	1	3	4	5	6	7	8	9	10	17	18	19	21	22	24	27	28	33	34	35	36	37
1. Student Age	—																					
3. PEP Raw Score	-.08	—																				
4. No. of Pupils in Class	.01	.09	—																			
5. Degree Status	.20	.02	-.19	—																		
6. IMRC	-.48	.14	.19	-.16	—																	
7. Post-test CAT Total	.32	.53	.18	.17	-.10	—																
8. Dummy Variable: School 1	-.08	-.07	-.28	-.37	.07	-.23	—															
9. Teacher Age	.17	-.01	-.26	.05	-.62	.08	-.11	—														
10. % White Students in Class	.28	.08	.36	.13	-.26	.32	-.22	.11	—													
17. Log mpy Whole Group Teacher	-.22	.04	-.12	.07	.14	-.07	-.04	.12	-.13	—												
18. Log mpy Small Group Teacher	-.14	-.12	-.19	-.09	.15	-.07	.41	-.30	-.07	-.35	—											
19. Log mpy Individual Help Teacher	-.15	.03	-.09	.14	.32	-.09	.17	.03	-.25	.02	.05	—										
21. Log mpy Total Small Group	.14	-.13	-.19	-.09	.14	-.09	.42	-.30	-.07	-.36	.99	.05	—									
22. Log mpy Total Indiv. Help	-.05	-.05	-.11	.11	.12	-.06	.16	.11	-.21	.04	.09	.71	.09	—								
24. Log mpy Total Teacher	-.19	.08	-.04	.01	[illegible]	-.00	-.10	-.04	.05	.41	.21	-.01	.16	.00	—							
27. Log mpy Total Unpaid Aide	-.01	-.06	-.09	.04	-.13	.01	-.03	.13	-.12	-.04	-.04	-.05	.06	.41	-.04	—						
28. z-score Pretest CAT Total	.35	.56	.15	.17	-.11	.87	-.23	.09	.28	-.09	-.08	-.10	-.10	-.09	-.01	-.01	—					
33. Interaction: CAT x Whole Grp. Inst.	-.16	-.12	-.21	.05	-.06	-.24	.04	.07	-.07	.10	-.16	.20	-.14	.21	-.03	.19	-.26	—				
34. Interaction: CAT x Small Grp. Inst.	.12	.06	.34	-.05	.10	.10	.05	-.17	.00	-.17	.20	.08	.20	.05	-.03	-.01	.14	-.29	—			
35. Interaction: CAT x Individual Help	.10	.08	-.10	-.08	-.09	.10	-.16	-.03	-.08	.19	.04	-.22	.04	-.20	.09	.11	.11	.00	.05	—		
36. Interaction: CAT x Individual Inst.	.02	.05	-.00	-.01	.00	.07	-.04	-.01	.01	.05	.10	-.20	.10	-.14	.11	.01	.06	-.08	-.19	.15	—	
37. % Working Poor/Unskilled Worker	-.05	-.06	.12	-.17	.39	-.07	.34	-.19	-.16	-.39	.34	.20	.34	.07	-.07	.13	-.09	-.28	.08	-.15	.00	—
	1	3	4	5	6	7	8	9	10	17	18	19	21	22	24	27	28	33	34	35	36	37

Table 7-2

Intercorrelations of Variables Used in the Regression Analysis-District B

Variables	1	3	4	5	6	7	8	9	10	11	12	13	14	15	22	23	24	25	26	27	28	29	30	31	32	33	38	39	40	41	42
1. Student Age	-																														
3. PEP Raw Score	-.15	-																													
4. No. of Pupils in Class	-.06	.25	-																												
5. Degree Status	.13	.01	-.13	-																											
6. INRU	-.09	.03	.13	-.07	-																										
7. Post-test CAT Total	.13	.60	.24	.16	.03	-																									
8. Dummy Variable: School 1	.06	-.19	-.30	-.02	-.05	-.26	-																								
9. Dummy Variable: School 2	.06	-.12	-.35	.08	-.31	-.18	-.17	-																							
10. Dummy Variable: School 3	-.04	-.04	-.08	-.04	-.03	-.00	-.09	-.12	-																						
11. Dummy Variable: School 4	.02	.15	.11	.21	.02	.22	-.17	-.23	-.12	-																					
12. Dummy Variable: School 5	.04	.02	.27	-.38	.23	.03	-.16	-.22	-.12	-.21	-																				
13. Dummy Variable: School 6	-.04	-.02	-.13	.19	-.11	.14	-.01	-.13	-.07	-.13	-.13																				
14. Teacher Age	-.01	.12	.08	.44	-.14	.13	-.14	.03	.04	.30	-.31	.25	-																		
15. % White in Class	-.31	.25	.36	.14	.16	.28	-.52	-.46	.05	.20	-.01	.23	.14	-																	
22. Log mpy Whole Group Teacher	.14	-.12	.18	.04	-.05	.18	-.04	-.22	-.01	-.04	.22	-.01	.05	.10	-																
23. Log mpy Small Group Teacher	-.08	-.00	-.26	-.08	-.04	-.04	-.00	.11	.07	.08	-.21	-.00	-.07	.01	-.22	-															
24. Log mpy Indiv. Help Teacher	-.02	-.02	.03	-.31	.23	-.09	.09	-.26	-.01	-.26	.30	-.16	-.33	.12	.37	-.03	-														
25. Log mpy Indiv. Instruc. Teacher	.19	-.07	.11	-.11	.03	.03	-.10	-.14	-.07	.09	.17	.25	-.04	-.15	-.02	-.07	-.16	-													
26. Log mpy Total Small Group	-.07	-.07	-.34	-.10	-.06	-.13	.00	.18	.05	.08	-.23	.04	-.09	-.04	-.26	.94	-.07	.00	-												
27. Log mpy Total Indiv. Help	-.04	-.07	.04	-.31	.21	-.15	.07	-.26	.08	-.15	.24	-.16	-.24	.12	.25	.02	.87	-.10	-.01	-											
28. Log mpy Total Indiv. Instruc.	.13	-.27	-.12	-.13	-.07	-.27	.13	.07	-.07	-.06	.09	.06	-.11	-.31	-.18	.02	-.08	.55	.10	-.02	-										
29. Log mpy Total Teacher	.00	.10	-.05	-.08	-.01	.11	.01	-.04	-.03	.10	.02	.00	-.01	-.01	.31	.35	.13	.07	.49	.13	-.33	-									
30. Log mpy Total Specialist	.08	-.32	-.20	-.06	-.11	-.35	.36	.12	-.05	-.03	-.03	-.01	-.03	-.28	-.18	.03	-.10	.13	.15	-.06	.73	-.07	-								
31. Log mpy Total Paid Aide	.03	-.27	-.11	-.02	-.08	-.33	.03	.18	.03	-.01	.00	0.07	-.02	-.15	-.07	.06	-.01	.06	.17	.24	.20	-.02	.11	-							
32. Log mpy Total Unpaid Aide	.06	-.10	.03	-.06	.05	-.11	.04	-.05	-.02	-.05	.13	-.03	-.01	-.10	.02	.02	.13	.12	.04	.18	.10	.04	.05	.17	-						
33. z-score: Pretest CAT Total	.18	.59	.24	.19	.02	.88	-.25	-.17	-.02	.21	.02	.14	.11	.26	.19	-.07	-.08	.01	-.13	-.14	-.28	.08	-.35	-.30	-.10	-					
38. Interaction: CAT x mpy Whole Group	-.11	-.09	.09	-.09	-.11	-.09	.03	-.08	.11	-.05	.17	-.12	-.08	.06	.02	-.14	.09	-.07	-.13	.11	.04	-.03	.07	.02	-.04	-.09	-				
39. Interaction: CAT x mpy Small Group	.03	-.04	-.27	-.08	-.04	-.05	.06	.03	.08	.12	-.13	.08	-.07	-.08	-.12	.19	-.06	.05	.18	-.07	.03	-.08	-.02	-.09	-.03	-.06	-.22	-			
40. Interaction: CAT x mpy Indiv. Help	.08	-.03	.05	.03	-.16	-.08	.00	.14	-.06	-.10	-.04	-.04	-.03	-.10	.10	-.10	-.24	.04	-.08	-.39	-.03	-.07	.03	-.17	-.22	-.01	.17	.00	-		
41. Interaction: CAT x mpy Indiv. Inst.	-.03	.10	.02	.03	.05	.06	-.08	.04	.00	.08	-.14	.04	.04	.09	.04	.08	-.04	.03	.03	-.04	-.42	.07	-.48	-.13	-.04	.08	-.19	.05	.03	-	
42. % Working Poor/Unskilled Worker	-.13	.08	-.02	.20	-.06	.04	-.23	.07	.10	-.05	-.15	.04	.11	.48	-.14	.12	.09	-.29	.07	.09	-.13	-.08	-.03	-.08	-.02	.03	.08	-.03	[illegible]	.03	-

Table 7.3 Intercorrelations of Variables Used in the Regression Analysis - District C

Variables	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23	28	29	30	31
1. **Student Age**	-																									
2. **No. of Pupils in Class**	-.08	-																								
3. Teacher Degree Status	-.01	.03	-																							
4. IMRU	-.05	.21	.03	-																						
5. Post-test CAT Total	.14	.45	-.12	.04	-																					
6. **Dummy** Variable: School 1	.07	-.49	.09	-.40	-.12	-																				
7. **Dummy** Variable: School 2	-.03	.10	.16	.51	-.14	-.28	-																			
8. **Dummy** Variable: School 3	-.04	.49	-.16	.09	.48	-.20	-.21	-																		
9. **Dummy** Variable: School 4	-.13	-.13	-.00	-.01	-.22	-.27	-.29	-.20	-																	
10. Teacher Age	-.05	.09	-.03	-.27	.03	-.25	-.20	.14	-.10	-																
11. **% White Students in Class**	.06	.70	-.13	.18	.51	-.42	.00	.44	-.52	.35	-															
13. **% Working Poor/Unskilled Worker**	-.09	-.14	-.05	-.01	-.32	.01	.10	-.39	-.01	-.00	-.14	-														
14. **Log mpy Whole** Group **Teacher**	.12	.13	-.15	.21	.15	-.15	-.01	.11	-.04	.12	.18	-.03	-													
15. **Log mpy** Small Group Teacher	.04	-.00	-.04	-.26	.08	.20	-.26	-.01	.33	-.10	-.11	.08	-.26	-												
16. **Log mpy** Individual Help Teacher	-.04	-.03	.18	.23	-.19	-.07	.22	-.06	.07	-.10	-.10	-.23	.03	-.04	-											
17. **Log mpy Individualized Instruc. Teacher**	-.12	-.10	.07	.23	-.05	.14	.06	-.11	.02	-.15	-.12	-.06	-.10	-.29	-.10	-										
18. Log mpy Total Teacher	.04	.02	-.16	.03	.17	.10	.06	.05	-.22	-.12	.06	-.02	.28	.29	-.11	.13	-									
19. **Log mpy Total Specialist**	-.02	-.05	-.01	.16	-.29	-.16	.23	-.05	.14	-.04	-.18	-.03	.08	-.13	.23	-.08	-.10	-								
20. Log mpy Total Paid Aide	.02	-.09	-.08	.03	-.29	-.06	-.14	-.16	.12	.07	-.01	.15	[illegible]	.02	.08	-.13	-.23	.09	-							
21. Log mpy Total Unpaid Aide	-.03	.02	.02	-.06	-.05	.04	-.09	.17	-.09	.11	.04	.01	.02	-.10	.04	.00	.01	.13	.00	-						
22. Log mpy Total Reading Instruction	.09	-.02	-.16	.09	.04	.04	.05	.00	-.30	.04	.19	.06	.28	.09	-.15	.13	.52	.08	.23	.11	-					
23. **z-score: Pretest CAT Total**	.15	.42	-.11	.03	.84	-.14	-.10	.42	-.20	.03	.47	-.31	.11	.10	-.14	-.05	.17	-.29	-.32	-.08	-.00	-				
28. Interaction: CAT x Whole Group Instruc.	-.02	.20	-.09	.07	.24	-.06	-.06	.18	-.06	-.02	.21	.01	-.09	-.01	-.12	.06	-.13	-.12	-.11	.00	-.10	.24	-			
29. Interaction: CAT x Small Group Instruc.	.04	.11	.03	-.04	.17	-.05	-.01	.07	-.05	.08	.10	-.02	-.01	.02	.05	-.01	-.06	.08	-.10	.10	-.06	.20	-.16	-		
30. Interaction: CAT x Individual Help	.02	-.21	.07	-.08	-.10	.13	.06	-.17	-.07	-.01	-.10	.18	-.15	-.01	-.21	.11	-.00	-.14	-.35	-.18	-.10	-.08	.05	-.12	-	
31. Interaction: CAT x Individualized Instruc.	.03	-.13	.08	-.11	-.14	.11	-.04	-.17	-.00	.06	-.07	.13	-.04	.01	-.12	-.04	-.01	-.18	.02	.00	-.05	-.17	-.15	-.24	.23	-
	1	2	3	4	5	6	7	8	9	10	11	13	14	15	16	17	18	19	20	21	22	23	28	29	30	31

Table 7.4 Intercorrelations of Variables Used in the Regression Analysis-District D

Variables	1	3	4	5	6	7	8	9	10	11	18	19	20	21	22	23	24	25	26	27	28	29	34	35	36	37	38
1. Student Age	—																										
3. PEP Raw Score	-.06	—																									
4. No. of Pupils in Class	-.13	.11	—																								
5. Degree Status	-.20	.06	-.11	—																							
6. IMRU	-.35	-.02	-.09	-.16	—																						
7. Post-test CAT Total	.20	.54	.10	-.04	-.16	—																					
8. Dummy Variable: Sch. 1	.06	-.36	.34	-.11	.03	-.51	—																				
9. Dummy Variable: Sch. 2	-.00	.09	-.30	-.21	-.17	.07	-.46	—																			
10. Teacher Age	.31	.06	.26	.10	-.48	.26	.05	-.22	—																		
11. % White Students in Class	.02	.41	-.13	.07	.10	.58	-.87	.18	-.01	—																	
18. Log mpy Whole Grp. Teacher	.10	-.06	.15	.35	-.66	.36	.02	.05	023	-.19	—																
19. Log mpy Small Grp. Teacher	-.50	-.12	-.13	.07	.59	-.29	.06	-.18	-.24	-.03	-.31	—															
20. Log myp Individual Inst. Teacher	.13	-.08	-.14	-.08	.01	.31	-.49	.04	.07	.49	-.01	-.17	—														
21. Log mpy Individualized Inst. Teacher	.18	.17	-.05	-.18	-.03	.14	-.12	.46	-.19	.15	-.28	-.34	-.24	—													
22. Log mpy Total Small Grp.	-.50	-.12	-.12	.06	.59	-.30	.08	-.19	-.26	-.05	-.32	.98	-.18	-.35	—												
23. Log mpy Total Individual Help	.09	-.01	-.21	-.06	.07	.13	-.37	.04	.04	.38	-.08	.07	.75	-.27	-.09	—											
24. Log mpy Total Individualized Inst.	.18	-.05	-.01	-.07	.05	-.13	-.00	.18	-.12	.07	-.29	-.23	-.07	.63	-.22	-.07	—										
25. Log mpy Total Teacher	-.19	-.01	-.10	-.01	.17	.07	-.15	.06	-.16	.14	-.03	.54	-.05	.13	.46	-.07	-.03	—									
26. Log mpy Total Specialist	.03	-.24	.04	.06	.09	-.32	.15	-.23	-.01	-.10	-.10	.04	.12	-.17	.08	.15	.61	-.21	—								
27. Log mpy Total Paid Aide	-.09	-.03	.09	.11	.12	-.09	-.01	-.14	-.02	.03	-.08	.11	-.07	-.10	.11	.45	.06	-.02	.15	—							
28. Log mpy Total Unpaid Aide	.03	-.16	-.43	-.07	-.11	-.18	-.11	.20	.03	.01	-.11	-.09	-.02	-.05	.09	.27	-.05	.05	-.01	.01	—						
29. z-score: Pretest CAT Total	.26	.52	.08	-.09	-.18	.88	-.51	.07	.25	.59	.05	-.33	.32	.19	-.33	.13	-.06	.05	-.29	-.12	-.15	—					
34. Interaction: CAT x mpy Whole Grp.	.13	-.01	.26	-.13	-.27	.13	-.14	-.06	.41	.24	.04	-.30	.33	-.16	-.30	.34	-.07	-.25	-.07	.03	.10	.15	—				
35. Interaction: CAT x mpy Small Grp	-.12	-.02	-.17	.06	.36	-.24	.19	-.18	-.32	-.16	-.30	.37	-.15	-.16	.37	-.11	-.05	-.04	.07	.08	-.05	-.26	-.40	—			
36. Interaction: CAT x mpy Indiv. Help	.02	-.09	.18	.05	-.12	.15	-.03	-.17	.21	.03	.35	-.10	.22	-.19	-.10	-.11	-.21	-.05	-.07	-.31	-.28	.11	.12	-.27	—		
37. Interaction: CAT x mpy Indiv. Inst.	-.01	.09	-.18	-.01	-.03	.03	-.02	.30	-.07	-.07	-.07	-.06	-.24	.36	-.06	-.21	-.04	.10	-.36	-.08	.01	.05	-.26	-.30	-.08	—	
38. % Working Poor/Unskilled Worker	.04	-.27	.28	-.11	.03	-.45	.83	-.22	-.18	-.77	.14	-.03	-.39	.05	-.00	-.34	.09	-.11	.12	-.04	-.14	-.43	-.34	.12	-.09	.09	—
	1	3	4	5	6	7	8	9	10	11	18	19	20	21	22	23	24	25	26	27	28	29	34	35	36	37	38

8.0 Multiple Regression Analysis

The model used in the multiple regression analysis of the district and CRT subsamples was noted in the Main Report.

The variables used and numbers identifying them are listed for each district subsample in Table 8.1 and CRT Level 4 and Level 5 in Table 8.2. As noted in Table 8.1, the dependent variable, the CAT post-test, was expressed in Achievement Development Scale Scores (ADSS), while the CAT pretest ADSS were further transformed to z-scores to facilitate their use in interactions. The raw score was used for the 3rd grade Pupil Evaluation Program (PEP) test of reading. The various modes of instructional time were expressed in the natural log of minutes per year. As with the CAT pre-test, the z-scores of the logs for the time variables were used for interactions.

The same scores were used in the analysis of the CRT subsamples with one exception. The CAT pre-test was also expressed in ADSS form. In addition, a value of 400 was added to the raw score of the CRT Level 4, and 500 to CRT Level 5.

Table 8.3 is a summary of the regression for the full model without interactions for the four districts. Regression analyses for each district, both with and without interactions, are presented in Tables 8.4-8.11.

Likewise, Tables 8.12 and 8.13 summarize the regressions for the CRT subsamples for Levels 4 and 5. In comparing student performance on criterion- and norm-referenced tests, 5 models were used for both levels. In the first three models at each level, the fourth test administration of the criterion referenced test (CRT) is the outcome measure or dependent variable. The first model includes the first administration of the CRT as a pretest while the second model includes both the CRT and the California Achievement Test (CAT) as a pretest. The CAT is the pretest in the third model. The fourth and fifth models include the CAT as the dependent variable while the CRT and CAT are the respective pretests. The complete regression analyses of the two subsamples are presented in Tables 8.14 through 8.23.

Finally, five more subsamples were analyzed using CRT Levels 2,3,4, and 5 and the CAT as outcome measures. These included the CRT as pretest, time variables, and student data. These regression analyses are presented in Table 8.24.

Table 8.1 Key to Variables Used In The Full Model Regression Analysis By District

Variable Name	District			
	A	B	C	D
Student Achievement				
Post-test CAT Total Reading-ADSS	7	7	5	7
Student Characteristics				
Age in half years	1	1	1	1
3rd Grade PEP Reading-Raw Score	3	3	–	3
Pre-test CAT Total Reading-z-Score	28	33	23	29
Teacher Characteristics				
Degree Status	5	5	3	5
Age	9	14	10	10
Reading Class Structure				
Number of pupils	4	4	2	4
% White Students	10	15	11	11
% Working Poor/Unskilled Worker	37	42	13	38
Instructional Materials				
IMRU	6	6	4	6
School Characteristics				
Dummy Variable for School 1	8	8	6	8
Dummy Variable for School 2	-	9	7	9
Dummy Variable for School 3	-	10	8	-
Dummy Variable for School 4	-	11	9	-
Dummy Variable for School 5	-	12	-	-
Dummy Variable for School 6	-	13	-	-
Instructional Time (minutes per year)				
Log mpy Whole Group Teacher	17	22	14	18
Log mpy Small Group Teacher	18	23	15	19
Log mpy Individual Help Teacher	19	24	16	20
Log mpy Individualized Instruc. Teacher	-	25	17	21
Log mpy Total Specialist Instruction	-	30	19	26
Log mpy Total Paid Aide Instruction	-	31	20	27
Log mpy Total Unpaid Aide Instruction	27	32	21	28
Log mpy Total Reading Instruction	-	-	23	-
Interactions of z-score Pretest CAT x Time				
z-score log mpy Whole Group	33	38	28	34
z-score log mpy Small Group	34	39	29	35
z-score log mpy Individual Help	35	40	30	36
z-score log mpy Individualized Instruc.	-	41	31	37

Table 8.2 Key To Variables Used In Full Model Regression Analysis of CRT Subsamples

	CRT Subsamples	
Variable Names	Level 4	Level 5
Student Achievement		
CRT Test Administration 4-Raw Score	2	2
CAT Post-test Reading Total-ADSS	10	10
Student Characteristics		
CRT Test Administration 1-Raw Score	1	1
Age	3	3
Father's Occupation	4	4
3rd Grade PEP Raw Score	5	5
CAT Pretest Reading Total-ADSS	9	9
Teacher Characteristics		
Degree Status	7	7
Age	11	11
Reading Class Structure		
Number of Pupils	6	6
% White Pupils	12	12
% Working Poor	13	13
% Unskilled Worker	14	14
% Skilled Blue Collar Worker	15	15
% Skilled White Collar Worker	16	16
% Business	17	17
% Professional	18	18
Instructional Materials	8	8
IMRU		
Instructional Time (minutes per year)		
Log mpy Whole Group Teacher	19	19
Log mpy Small Group Teacher	20	20
Log mpy Individual Help Teacher	21	21
Log mpy Individualized Instruction Teacher	22	22
Log mpy Total Specialist	23	23
Log mpy Total Paid Aide	24	24
Log mpy Total Unpaid Aide	25	25

Table 8.3 Raw Regression Estimates of Reading Program Components on Student Performance Within School Districts

	District			
Explanatory Variable	A (N=567)	B (N=947)	C (N=967)	D (N=523)
Student Characteristics				
CAT Ability (Pretest)	50.032***	53.636***	48.932***	52.662***
PEP Ability	.509**	.811***	-	.615***
Age	1.049	.897	.892	1.077
Teacher Characteristics				
Age	.061	.066	-.252	.472*
Degree Status	3.051	-.342	-.317	2.292
Reading Class Structure				
Number of Pupils	.099	.127	.382	.751
% White	.729***	.040	.562***	.057
% Working Poor/Unskilled Worker	.160	.130	-.098*	.081
Instructional Materials				
INRU	.157	.233	.447	.020
School Characteristics				
School A	-1.923	-4.560	26.559***	-21.741
School B	-	-.037	8.955	-.571
School C	-	8.606	28.521***	
School D	-	6.510	23.432*	-
School E	-	6.184	-	-
School F	-	8.731	-	-
Instructional Time[a]				
Teacher Whole Group	.637	.435	1.125*	-.818
Teacher Small Group	.289	.655	.511	-.435
Teacher Individual Help	.040	-1.712	4.803***	.256
Teacher Individualized Instruction	-	.254	-1.010	-1.746
Total Specialist	-	-1.106*	-1.793*	-3.084***
Total Paid Aide	-	-2.583***	-1.231*	.075
Total Unpaid Aide	2.329	-2.205	- .203	-6.941**
Multiple R	.880	.893	.870	.899
Multiple R^2	.774	.797	.757	.808
F Value	135.358	164.457	154.841	117.657

Note: A dash (-) in this table indicates that the variable does not apply in that district. The dependent variable is the California Achievement Test.

[a] All time variables are natural log transformation of minutes per year.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 8.4 Regression Analysis of CAT on Full Model for District A

```
SAMPLE SIZE      567
NO. OF VARIABLES 15       NO. OF VARIABLES DELETED 22  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7744
MULTIPLE CORR. COEFFICIENT    0.8800

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    1834748.98602
SUM OF SQUARES OF DEVIATION FROM REGRESSION   525706.18194

VARIANCE OF ESTIMATE      952.36627
STD. ERROR OF ESTIMATE     30.86043

INTERCEPT (A VALUE)   314.57508


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
     SOURCE OF VARIATION         D.F.     SUM OF          MEAN          F
                                          SQUARES         SQUARES       VALUE
 DUE TO REGRESSION..............   14   1834748.98602   128910.64186   135.3583
 DEVIATION ABOUT REGRESSION...   552    525706.18194      952.36627
                         TOTAL...  566   2330455.16796


VARIABLE     MEAN        STD.       REG.       STD.ERROR    COMPUTED    PARTIAL     SUM OF SQ.    PROP. VAR.
  NO.                 DEVIATION    COEFF.     OF REG.COF.   T VALUE    CORR. COE.     ADDED        CUM.
   1       21.27243    1.70533    1.04864     1.04143     1.00692     0.04282    242895.66450   0.10423
   3       32.03034   10.45463    0.50923     0.16552     3.07653     0.12984    738383.13966   0.31684
   4       30.57354    4.26229    0.09898     0.41805     0.23677     0.01008     41047.61005   0.01761
   5        6.84586    0.80283    3.05149     2.11495     1.44289     0.06139     28047.75933   0.01204
   6        9.14286    3.14366    0.15698     0.82888     0.18941     0.00806      1835.37574   0.00079
   8        0.57143    0.49531   -1.92265     4.06089    -0.47345    -0.02015     19837.04110   0.00851
   9       43.48677    9.60433    0.06142     0.22115     0.27773     0.01182      6183.96917   0.00265
  10       99.03316    9.70642    0.72864     0.18774     3.88122     0.16299     49009.12207   0.02103
  17        5.53204    2.80731    0.63736     0.66672     0.95597     0.04066      6500.59971   0.00279
  18        7.61801    2.26160    0.28913     0.73498     0.39338     0.01674       432.55746   0.00019
  19        2.02658    0.93958    0.03965     1.73548     0.02285     0.00097      5931.30012   0.00255
  27        2.19278    0.67833    2.32858     2.01778     1.15408     0.04906      8892.54004   0.00382
  28        3.03282    1.86472   50.03246     1.90701    26.23609     0.74496    653701.48129   0.28053
  37       25.97160   16.64773    0.15954     0.10873     1.46741     0.06234      2050.71093   0.00088
   7      461.73739   64.16706

COMP. CHECK ON FINAL COEFF.        0.15954


VARIABLES DELETED...  2 11 12 13 14 15 16 20 21 22 23 24 25 26 29 30 31 32 33 34 35 36
```

173

Table 8.5 Regression Analysis of CAT on Full Model Including Interactions for District A

```
SAMPLE SIZE      567
NO. OF VARIABLES 19      NO. OF VARIABLES DELETED 18  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7756
MULTIPLE CORR. COEFFICIENT    0.8807

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     1807384.95526
SUM OF SQUARES OF DEVIATION FROM REGRESSION    523070.21271

VARIANCE OF ESTIMATE       954.50769
STD. ERROR OF ESTIMATE      30.89511

INTERCEPT (A VALUE)    308.43908


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
      SOURCE OF VARIATION       D.F.     SUM OF          MEAN         F
                                         SQUARES        SQUARES      VALUE
DUE TO REGRESSION.............   18   1807384.95526   100410.27529   105.1959
DEVIATION ABOUT REGRESSION...   548    523070.21271      954.50769
                     TOTAL...   566   2330455.16796


VARIABLE     MEAN        STD.        REG.      STD.ERROR    COMPUTED    PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                 DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED          CUM.
    1      21.77743     1.70530     1.05082     1.05046     1.00040     0.04273    242895.66450    0.10423
    3      32.93334    10.45460     0.49723     0.16629     2.99113     0.12670    738383.13966    0.31684
    4      30.97354     4.26229     0.27392     0.46762     0.58561     0.02501     41047.61805    0.01761
    5       6.64506     0.80283     3.06372     2.12265     1.44337     0.06154     28047.79933    0.01204
    6       9.14286     3.14306     0.16655     0.83183     0.20322     0.00855      1835.37574    0.00079
    8       0.57143     0.49531    -1.19708     4.10259    -0.29179    -0.01246     19837.04110    0.00851
    9      43.48677     9.60433     0.04897     0.22339     0.21963     0.00938      6183.96817    0.00265
   10      89.33316     8.70642     0.72657     0.19349     3.75497     0.15838     49009.12207    0.02103
   17       5.93204     2.80701     0.46368     0.67888     0.68301     0.02916      6505.59971    0.00279
   18       7.81831     2.26160     0.29211     0.78621     0.37155     0.01587       432.55746    0.00019
   19       2.62658     0.90988     1.06112     1.87602     0.56562     0.02416      5931.36612    0.00255
   27       2.39278     0.67833     2.54368     2.06729     1.23044     0.05249      8892.54084    0.00382
   28      -0.03282     1.00472    49.75804     1.94940    25.54528     0.73726    653701.48129    0.28052
   33      -0.08098     1.04974    -1.37958     1.51913    -0.90814    -0.03876       764.84836    0.00033
   34      -0.09991     0.85956    -2.26710     1.89193    -1.19830    -0.05112      2106.41348    0.00091
   35      -0.09547     1.13638     1.01761     1.27639     0.79726     0.03414       722.85261    0.00031
   36      -0.16296     1.49926     0.33322     0.94430     0.35288     0.01507        91.26469    0.00004
   37      25.97169    16.64773     0.11706     0.11429     1.02420     0.04371      1001.26462    0.00043
    7     451.73739    64.16706

COMP. CHECK ON FINAL-COEFF.       0.11706


VARIABLES DELETED...  2 11 12 13 14 15 16 20 21 22 23 24 25 26 29 30 31 32
```

Table 8.6 Regression Analysis of CAT on Full Model For District B

```
SAMPLE SIZE     947
NO. OF VARIABLES 23        NO. OF VARIABLES DELETED 19  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION   0.7966
MULTIPLE CORR. COEFFICIENT     0.8925

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     3909335.21862
SUM OF SQUARES OF DEVIATION FROM REGRESSION    998387.49230

VARIANCE OF ESTIMATE    1080.50594
STD. ERROR OF ESTIMATE    32.87105

INTERCEPT (A VALUE)    396.28816


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
       SOURCE OF VARIATION       D.F.      SUM OF         MEAN           F
                                           SQUARES        SQUARES        VALUE
DUE TO REGRESSION............    22   3909335.21862  177697.05539   164.4573
DEVIATION ABOUT REGRESSION...   924    998387.49230    1080.50594
                     TOTAL...   946   4907722.71093


VARIABLE     MEAN         STD.        REG.      STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                   DEVIATION    COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED          CUM.
   1       22.20000     1.99524     0.90574     0.64950      1.39451      0.04583     80563.10402     0.01642
   3       28.06938    10.23760     0.81157     0.14148      5.73617      0.18543   1941546.11132     0.39561
   4       24.61457     4.63696     0.14694     0.36095      0.40710      0.01339     47869.77804     0.00975
   5        6.00634     1.07536    -0.32155     1.31473     -0.24457     -0.00805     93978.03054     0.01915
   5       11.32735     4.16044     0.22444     0.29999      0.74816      0.02461      3525.22133     0.00072
   8        0.11088     0.31414    -4.24458     7.36504     -0.57631     -0.01896     92581.51646     0.01886
   9        0.19535     0.39668     0.26509     6.48929      0.04085      0.00134    101798.07680     0.02074
  10        0.06019     0.23796     8.77483     5.68034      1.54477      0.05075       331.48931     0.00007
  11        0.17951     0.38399     6.74093     4.59292      1.46768      0.04823      3289.20115     0.00067
  12        0.17212     0.37769     6.39733     4.20655      1.52080      0.04997       261.66260     0.00005
  13        0.07181     0.25830     8.98234     6.29196      1.42759      0.04691     38412.96782     0.00783
  14       39.64604    12.14516     0.06594     0.11384      0.57923      0.01905     14856.53559     0.00303
  15       83.01943    18.15113     0.05647     0.13818      0.40868      0.01344       579.88291     0.00012
  22        5.41988     2.90557     0.42067     0.44996      0.93490      0.03074     12218.25232     0.00249
  23        7.53108     2.36996     0.64929     0.50472      1.28643      0.04228       102.83173     0.00002
  24        3.09029     1.39692    -1.69007     1.05542     -1.60132     -0.05261     17623.70460     0.00359
  25        2.74305     1.55872     0.23481     0.88963      0.26394      0.00868     16514.33326     0.00336
  30        3.37166     2.26932    -1.10284     0.53648     -2.05570     -0.06747     86551.91713     0.01764
  31        2.88120     1.77381    -2.59138     0.66373     -3.90424     -0.12739    106802.87932     0.02176
  32        2.35751     0.56281    -2.20265     2.00903     -1.09638     -0.03604      3248.85613     0.00066
  33        0.00222     1.00500    53.63218     1.57895     33.96691      0.74518   1246630.26385     0.25401
  42       37.22101    32.51469     0.00787     0.05994      0.13121      0.00432        18.60235     0.00000
   7      440.39704    72.02685

COMP. CHECK ON FINAL COEFF.         0.00787

VARIABLES DELETED...  2 16 17 18 19 20 21 26 27 28 29 34 35 36 37 38 39 40 41
```

Table 8.7 Regression Analysis of CAT Including Interactions on District B

```
SAMPLE SIZE      947
NO. OF VARIABLES 27        NO. OF VARIABLES DELETED 15  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7996
MULTIPLE CORR. COEFFICIENT    0.8942

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     3924342.09191
SUM OF SQUARES OF DEVIATION FROM REGRESSION    983380.61901

VARIANCE OF ESTIMATE     1068.89198
STD. ERROR OF ESTIMATE     32.69391

INTERCEPT (A VALUE)    398.50462

                   ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
     SOURCE OF VARIATION        D.F.     SUM OF         MEAN          F
                                         SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............   26  3924342.09191  150936.23430   141.2081
DEVIATION ABOUT REGRESSION...   920   983380.61901    1068.89198
                      TOTAL...  946  4907722.71093

VARIABLE     MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.     PROP. VAR.
 NO.                    DEVIATION    COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED          CUM.
    1      22.20000     1.99524     0.88643     0.65114     1.36136     0.04484      80563.10402     0.01642
    3      28.06938    10.23760     0.79003     0.14166     5.57675     0.18083    1941546.11132     0.39561
    4      24.61457     4.63696     0.12943     0.36551     0.32949     0.01086      47869.77804     0.00975
    5       6.00634     1.07536    -0.82518     1.32137    -0.62449    -0.02058      93978.03054     0.01915
    6      11.32735     4.16044     0.23522     0.30499     0.77123     0.02542       3525.22133     0.00072
    8       0.11088     0.31414    -1.96620     7.39837    -0.26576    -0.00876      92581.51646     0.01886
    9       0.19535     0.39668     3.26488     6.51707     0.50097     0.01651     101798.07680     0.02074
   10       0.06019     0.23796    10.80744     5.78995     1.06659     0.06142        331.48931     0.00007
   11       0.17951     0.38399    10.04465     4.72662     2.12513     0.06989       3289.20115     0.00067
   12       0.17212     0.37769     5.70809     4.30338     1.32642     0.04369        261.66260     0.00005
   13       0.07181     0.25830    13.52929     6.31981     1.71355     0.05640      38412.96782     0.00783
   14      39.64604    12.14516     0.03506     0.11436     0.30655     0.01011      14856.53559     0.00303
   15      83.01943    18.15113     0.10544     0.13904     0.75838     0.02500        579.88291     0.00012
   22       5.41988     2.90557     0.49527     0.46275     1.07028     0.03526      12218.25232     0.00249
   23       7.53108     2.36996     0.69530     0.50741     1.37030     0.04513        102.83173     0.00002
   24       3.09029     1.39692    -1.75134     1.10995    -1.57786    -0.05195      17623.70460     0.00359
   25       2.74305     1.55872     0.66639     0.89357     0.74576     0.02458      16514.33326     0.00336
   30       3.37166     2.26932    -2.29804     0.62740    -3.66279    -0.11989      86581.91713     0.01764
   31       2.88120     1.77381    -3.11435     0.68947    -4.51775    -0.14732     106802.87932     0.02176
   32       2.35751     0.56281    -2.21302     2.03225    -1.08895    -0.03589       3248.85613     0.00066
   33       0.00222     1.00500    52.80509     1.59177    33.17385     0.73802    1246630.26385     0.25401
   34       0.19684     1.00296    -1.36695     1.22836    -1.11283    -0.03666        149.17045     0.00003
   39      -0.13279     1.10453    -1.45501     1.09574    -1.32788    -0.04374       1211.54327     0.00025
   40      -0.13757     1.05063     0.22406     1.19626     0.18730     0.00618         14.19126     0.00000
   41      -0.27320     1.01197    -4.65139     1.30260    -3.57086    -0.11692      13472.11752     0.00275
   42      37.22101    32.51469     0.02446     0.05987     0.40860     0.01347        178.45284     0.00034
    7     446.39704    72.02685
```

Table 8.8 Regression Analysis of CAT on Full Model for District C

```
SAMPLE SIZE      967
NO. OF VARIABLES 20        NO. OF VARIABLES DELETED 15   (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  5

COEFFICIENT OF DETERMINATION  0.7565
MULTIPLE CORR. COEFFICIENT    0.8698

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     4052930.41271
SUM OF SQUARES OF DEVIATION FROM REGRESSION  1304603.25915

VARIANCE OF ESTIMATE    1377.61696
STD. ERROR OF ESTIMATE    37.11626

INTERCEPT (A VALUE)    356.32361


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
    SOURCE OF VARIATION       D.F.      SUM OF          MEAN           F
                                        SQUARES        SQUARES        VALUE
DUE TO REGRESSION............  19  4052930.41271  213312.12698   154.8414
DEVIATION ABOUT REGRESSION...  947  1304603.25915    1377.61696
                    TOTAL...  966  5357533.67187


VARIABLE      MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
 NO.                    DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
  1        21.80807     2.20894     0.89174     0.57976     1.53813     0.04992    102773.72537    0.01918
  2        22.78883     4.59901     0.38224     0.58579     0.65252     0.02128   1166551.32156    0.21774
  3         5.90290     0.97668    -0.31705     1.38644    -0.22868    -0.00743     97526.86053    0.01820
  4        11.81696     4.34327     0.44706     0.47227     0.94661     0.03075     10287.49998    0.00192
  6         0.21406     0.41038    26.55879     7.91666     3.35480     0.10837     82893.96159    0.01547
  7         0.22854     0.42011     8.95524     7.80560     1.14728     0.03726    106361.43548    0.01984
  8         0.13133     0.33794    28.52089     6.48890     4.39533     0.14139    301545.78313    0.05628
  9         0.21717     0.41253    23.43249    10.07233     2.32642     0.07538     57057.89623    0.01065
 10        31.25946     9.50441    -0.25187     0.16820    -1.49741    -0.04860     21957.71034    0.00410
 11        41.50352    29.50301     0.56169     0.16301     3.44568     0.11127    320670.92960    0.05985
 13        58.64043    34.55560    -0.09791     0.04556    -2.14922    -0.06967     34100.59939    0.00636
 14         6.01546     2.98334     1.12473     0.46906     2.39785     0.07768     20936.67153    0.00391
 15         7.63815     2.68137     0.51076     0.57033     0.89556     0.02939     78726.40389    0.01469
 16         2.76252     1.30959    -4.80320     1.05868    -4.53697    -0.14586    153322.36930    0.02862
 17         2.78916     1.78777    -1.01046     0.82845    -1.21970    -0.03960      6991.81060    0.00131
 19         3.07633     1.95316    -1.79284     0.70522    -2.54224    -0.08233    130570.69865    0.02437
 20         3.43445     2.36858    -1.23086     0.58023    -2.12135    -0.06877    164625.27022    0.03073
 21         2.45599     0.94307    -0.20318     1.34595    -0.15096    -0.00491      8664.00501    0.00162
 23         0.00052     1.00260    48.93152     1.66667    29.35884     0.69028   1187425.45153    0.22164
  5       398.51955    74.47215

COMP. CHECK ON FINAL COEFF.           48.93152

VARIABLES DELETED... 12 18 22 24 25 26 27 28 29 30 31 32 33 34 35
```

Table 8.9 Regression Analysis of CAT on Full Model Including Interactions for District C

```
SAMPLE SIZE    967
NO. OF VARIABLES 24      NO. OF VARIABLES DELETED 11  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  5

COEFFICIENT OF DETERMINATION  0.7600
MULTIPLE CORR. COEFFICIENT    0.8718

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     4071936.51544
SUM OF SQUARES OF DEVIATION FROM REGRESSION  1285597.15637

VARIANCE OF ESTIMATE    1363.30557
STD. ERROR OF ESTIMATE    36.92297

INTERCEPT (A VALUE)   362.65273

                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.      SUM OF         MEAN          F
                                           SQUARES       SQUARES       VALUE
DUE TO REGRESSION............    23  4071936.51544  177040.71806   129.8614
DEVIATION ABOUT REGRESSION...   943  1285597.15637    1363.30557
                     TOTAL...   966  5357533.67187

VARIABLE     MEAN         STD.         REG.       STD.ERROR      COMPUTED     PARTIAL      SUM OF SQ.     PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.    T VALUE     CORR. COE.      ADDED          CUM.
   1       21.80807     2.20894     0.95606     0.57816       1.65361      0.05377    102773.72537     0.01918
   2       22.78883     4.59901     0.31577     0.58730       0.53766      0.01751   1166551.32156     0.21774
   3        5.90290     0.97668    -0.09791     1.38472      -0.07070     -0.00230     97526.86053     0.01822
   4       11.81696     4.34327     0.52807     0.47127       1.12052      0.03647     10287.49998     0.00192
   6        0.21406     0.41038    25.38447     7.91346       3.20776      0.10389     82893.96159     0.01547
   7        0.22854     0.42011     8.25429     7.77305       1.06191      0.03456    106301.43548     0.01984
   8        0.13133     0.33794    25.97660     6.50447       3.99365      0.12897    301545.78313     0.05628
   9        0.21717     0.41253    21.69565    10.06079       2.15646      0.07005     57057.89623     0.01065
  10       31.25946     9.50441    -0.22848     0.16807      -1.35943     -0.04423     21957.71034     0.00410
  11       41.50352    29.50301     0.53541     0.16291       3.28641      0.10641    320670.92960     0.05985
  13       58.64043    34.55560    -0.11232     0.04598      -2.44300     -0.07930     34100.59939     0.00636
  14        6.01546     2.98334     1.15257     0.47612       2.42077      0.07859     20936.67153     0.00391
  15        7.63815     2.68137     0.[illegible]4301     0.56910       0.77844      0.02534     78726.40389     0.01469
  16        2.76252     1.30959    -5.39975     1.07517      -5.02222     -0.16140    153322.36930     0.02862
  17        2.78916     1.78777    -1.37435     0.83154      -1.65279     -0.05374      6991.81860     0.00131
  19        3.07633     1.95316    -2.82494     0.77669      -3.63717     -0.11762    130570.69865     0.02437
  20        3.43445     2.36858    -1.56752     0.63530      -2.46737     -0.08009    164625.27022     0.03073
  21        2.45599     0.94307    -0.49603     1.37857      -0.35982     -0.01172      8664.00501     0.00162
  23        0.00052     1.00260    47.14003     1.74273      27.04958      0.66099   1187425.45153     0.22164
  28        0.10805     0.91593     1.48421     1.47234       1.00806      0.03281      1577.97106     0.00029
  29        0.06006     0.83716     2.01295     1.58004       1.27399      0.04145      5483.14966     0.00102
  30       -0.28909     0.90700    -2.13433     1.60574      -1.32919     -0.04324      4149.95343     0.00077
  31       -0.25713     0.86313    -3.98933     1.66835      -2.39118     -0.07763      7795.02846     0.00145
   5      398.51955    74.47215

COMP. CHECK ON FINAL COEFF.        -3.98933

VARIABLES DELETED... 12 18 22 24 25 26 27 32 33 34 35
```

Table 8.10 Regression Analysis of CAT on Full Model for District D

```
SAMPLE SIZE     523
NO. OF VARIABLES 19       NO. OF VARIABLES DELETED 19  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.8078
MULTIPLE CORR. COEFFICIENT    0.8988

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2359726.50964
SUM OF SQUARES OF DEVIATION FROM REGRESSION    561567.01379

VARIANCE OF ESTIMATE      1114.22027
STD. ERROR OF ESTIMATE      33.37994

INTERCEPT (A VALUE)    372.95412


             ANALYSIS OF VARIANCE FOR THE MULTIPLE
                     LINEAR  REGRESSION
      SOURCE OF VARIATION       D.F.      SUM OF        MEAN          F
                                          SQUARES       SQUARES       VALUE
DUE TO REGRESSION............   18  2359726.50964  131095.91720   117.6571
DEVIATION ABOUT REGRESSION...  504   561567.01379    1114.22027
                    TOTAL...   522  2921293.52343


VARIABLE     MEAN          STD.         REG.       STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION      COEFF.    OF REG.COE.    T VALUE    CORR. COE.       ADDED        CUM.
   1       21.57208      1.92561      1.07717      1.18051      0.91246      0.04061    113097.17312     0.03871
   3       30.68413     10.13740      0.61501      0.18444      3.33446      0.14692    904053.39859     0.30947
   4       25.15296      4.32044      0.75093      0.61502      1.22099      0.05431     13493.98150     0.00462
   5        5.53155      0.74949      2.29214      2.79344      0.82055      0.03653       659.23634     0.00023
   6       10.91969      3.30929      0.02049      0.92484      0.02216      0.00099     15057.72915     0.00515
   8        0.46845      0.49948    -21.74139     12.36108     -1.75886     -0.07811    504954.79065     0.17285
   9        0.19312      0.39512     -0.57074      7.83190     -0.07287     -0.00325     33447.33899     0.01145
  10       37.19197      9.79111      0.47163      0.21927      2.15091      0.09537     29200.93502     0.01000
  11       63.94532     32.74722      0.05702      0.15102      0.37759      0.01682     14023.05913     0.00480
  18        4.38795      2.69905     -0.81846      1.10267     -0.74226     -0.03304     24609.31414     0.00842
  19        7.28989      3.11621     -0.43466      0.76582     -0.56757     -0.02527     23209.03025     0.00794
  20        3.45153      1.69918      0.25633      1.25264      0.20463      0.00911      1151.49245     0.00039
  21        3.08494      2.17631     -1.74599      1.13426     -1.53932     -0.06841      8629.64081     0.00295
  26        3.41143      2.34606     -3.08428      0.72106     -4.27744     -0.18717    105687.13257     0.03618
  27        2.69572      1.41734      0.07523      1.09049      0.06898      0.00307      5211.94762     0.00178
  28        2.40854      0.72584     -6.94136      2.47270     -2.80720     -0.12408     26351.42632     0.00902
  29       -0.00115      1.00325     52.66163      2.41121     21.84037      0.69731    536326.58457     0.18359
  38       38.09446     30.92042      0.08078      0.11371      0.71039      0.03163       562.29779     0.00019
   7      422.46272     74.80874

COMP. CHECK ON FINAL COEFF.        0.08078


VARIABLES DELETED....  2 12 13 14 15 16 17 22 23 24 25 30 31 32 33 34 35 36 37
```

Table 8.11 Regression Analysis of CAT on Full Model Including Interactions for District D

```
SAMPLE SIZE      523
NO. OF VARIABLES 23      NO. OF VARIABLES DELETED 15  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION   0.8117
MULTIPLE CORR. COEFFICIENT     0.9010

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2371329.25836
SUM OF SQUARES OF DEVIATION FROM REGRESSION    549964.26507

VARIANCE OF ESTIMATE      1099.92853
STD. ERROR OF ESTIMATE      33.16517

INTERCEPT (A VALUE)     371.78579

              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION       D.F.      SUM OF         MEAN          F
                                         SQUARES        SQUARES       VALUE
DUE TO REGRESSION............   22  2371329.25836  107787.69356    97.9952
DEVIATION ABOUT REGRESSION...  500   549964.26507    1099.92853
                       TOTAL...  522  2921293.52343

VARIABLE     MEAN         STD.        REG.       STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
   NO.                  DEVIATION    COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED         CUM.
    1     21.57208     1.92561     1.07255     1.18401      0.90586     0.04048    113097.17312    0.03871
    3     30.68413    10.13740     0.64299     0.18723      3.43424     0.15180    904053.39859    0.30947
    4     25.15296     4.32044     0.96087     0.64911      1.48028     0.06606     13493.98150    0.00462
    5      5.53155     0.74949     2.62730     2.82845      0.92888     0.04151       659.23634    0.00023
    6     10.91969     3.30929    -0.40741     0.94816     -0.42968    -0.01921     15057.72915    0.00515
    8      0.46845     0.49948   -14.25141    13.02007     -1.09457    -0.04889    504954.73065    0.17285
    9      0.19312     0.39512     3.53247     8.09188      0.43655     0.01952     33447.33899    0.01145
   10     37.19197     9.79111     0.45331     0.23005      1.97047     0.08778     29200.93502    0.01000
   11     63.94532    32.74722     0.12417     0.15664      0.79270     0.03543     14023.05913    0.00480
   18      4.38795     2.69905    -2.00527     1.23257     -1.62690    -0.07257     24609.31414    0.00842
   19      7.28989     3.11621    -0.95614     0.80889     -1.18205    -0.05279     23209.03025    0.00794
   20      3.45153     1.69918     0.22331     1.28217      0.17417     0.00779      1151.49245    0.00039
   21      3.08494     2.17631    -2.57918     1.18895     -2.16928    -0.09656      8629.64081    0.00295
   26      3.41143     2.34606    -3.55532     0.77624     -4.58017    -0.20067    105687.13257    0.03618
   27      2.69572     1.41734     0.57238     1.16618      0.49082     0.02194      5211.94762    0.00178
   28      2.40854     0.72584    -5.62911     2.62927     -2.14094    -0.09531     26351.42632    0.00902
   29     -0.00115     1.00325    51.67564     2.44041     21.17503     0.68759    536326.58457    0.18359
   34      0.05446     1.07122    -6.00378     2.26279     -2.65326    -0.11783      5547.68066    0.00190
   35     -0.32992     1.05363    -3.72629     2.14780     -1.73494    -0.07736      1368.92734    0.00047
   36      0.13340     1.03009     1.74831     1.91345      0.91370     0.04083      1141.45745    0.00039
   37     -0.06107     1.01479    -3.84453     1.99035     -1.93159    -0.08606      4093.04326    0.00140
   38     38.09446    30.92042     0.01414     0.12652      0.11176     0.00500        13.73833    0.00000
    7    422.46272    74.80874

COMP. CHECK ON FINAL COEFF.        0.01414

VARIABLES DELETED...  2 12 13 14 15 16 17 22 23 24 25 30 31 32 33
```

Table 8.12 Raw Regression Estimates of Criterion and Norm-Referenced Performance in Full Explanatory Models
CRT Level 4 Sub-sample (N=607)

	Outcome Measure				
Explanatory Variables	1 CRT	2 CRT	3 CRT	4 CAT	5 CAT
Pretest					
Criterion-Referenced Test	.426***	.309***	D	3.103***	D
California Achievement	D	.042***	.053***	D	.641***
Classroom Conditions					
No. of Pupils	-.173***	-.150***	-.180***	-.011	.166
% White	.053***	.029***	.037***	.481***	.185**
% Working Poor	-.023*	-.016	-.023*	-.157	-.104
% Unskilled Worker	-.008	-.002	-.004	-.133	-.052
% Skilled Blue Collar	-.039***	-.033***	-.048***	-.008	.005
% Skilled White Collar	-.018	-.022	-.027*	-.034	-.111
% Business	-.001	.003	.019	-.422*	-.290
% Professional	.062*	.081***	.089***	.405	.714***
Teacher Background					
Age	.037*	.035*	.042*	.077	.079
Degree Status	-.544**	-.626***	-.755***	.144	-1.703
Student Aptitude					
Pupil Evaluation Program Test	.129***	.063**	.075***	1.533***	.673***
Student Background					
Age	.006	-.098	-.109	2.825**	1.326
Father's Occupation	-.253*	-.281**	-.291**	2.071**	1.636*
Quantity of Instruction					
mpy Whole Group Teacher	-.170*	-.156**	-.191**	.491	.521
mpy Small Group Teacher	-.084	-.011	.004	-1.045	.039
mpy Individual Help Teacher	.073	.087	-.001	-2.030	-2.263*
mpy Individualized Instr. Teacher	.167	.097	.069	-.199	-1.299
mpy Total Specialist	.027	.013	.055	.027	.036
mpy Total Paid Aide	.013	.082	.063	-2.325	-1.456
mpy Total Unpaid Aide	-.162	-.089	-.007	-2.811	-1.410
Multiple R	.685	.747	.705	.677	.804
Multiple R^2	.470	.558	.497	.458	.647
F Value	23.495	31.977	26.172	22.458	48.610

Note: "D" indicates variable was deleted from regression model.

* $p < .05$
** $p < .01$
*** $p < .001$

Table 8.13 Raw Regression Estimates of Criterion-and Norm-Referenced Performance in Full Explanatory Models
CRT Level 5 Subsample (N=497)

Explanatory Variables	Outcome Measure 1 CRT	2 CRT	3 CRT	4 CAT	5 CAT
Pretest					
Criterion-Referenced Test	.556***	.431***	D	3.450***	D
California Achievement	D	.038***	.061***	D	.758***
Classroom Conditions					
No. of Pupils	-.177***	-.224***	-.385***	2.494***	1.193***
% White	.022	-.011	-.004	.409***	.192*
% Working Poor	-.013	-.007	-.001	.047	.182
% Unskilled Worker	-.024*	-.025*	-.041***	.288**	.229*
% Skilled Blue Collar	-.054***	-.052***	-.080***	-.037	-.070
% Skilled White Collar	-.010	-.018	-.028	.196	.022
% Business	.048	.062*	.091**	-.581*	-.252
% Professional	.004	.006	-.012	.706**	.691**
Teacher Background					
Age	.029	.017	.017	.498*	.265
Degree Status	-.389	-.455	-.503*	.468	-.976
Student Aptitude					
Pupil Evaluation Program	.043	-.008	-.012	1.273***	.319
Student Background					
Age	-.062	-.168	-.312*	-1.948	-4.281***
Father's Occupation	.024	-.043	-.070	.733	-.565
Quantity of Instruction					
mpy Whole Group Teacher	-.242**	-.168*	-.188*	-1.018	.285
mpy Small Group Teacher	-.395***	-.380***	-.577***	.692	.453
mpy Individual Help Teacher	.634***	.559**	.448**	2.554	.998
mpy Individualized Instr. Teacher	.078	.212	.360*	-3.063*	-.183
mpy Total Specialist	-.110	-.032	-.130	-2.53	-1.347
mpy Total Paid Aide	-.195	-.088	.047	-.699	1.638
mpy Total Unpaid Aide	48.889	57.424	94.200	-237.244	17.895
Multiple R	.758	.783	.730	.632	.776
Multiple R^2	.575	.613	.533	.399	.603
F Value	30.619	34.154	25.804	15.026	34.285

Note: "D" indicates variable was deleted from regression model.

$^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Table 8.14 Regression Analysis of CRT 4,
TA 4 on Full Model Including CRT 4, TA 1

```
SAMPLE SIZE      607
NO. OF VARIABLES 23       NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  2

COEFFICIENT OF DETERMINATION  0.4695
MULTIPLE CORR. COEFFICIENT    0.6852

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION        7799.79919
SUM OF SQUARES OF DEVIATION FROM REGRESSION      8812.42542

VARIANCE OF ESTIMATE        15.08977
STD. ERROR OF ESTIMATE       3.88456

INTERCEPT (A VALUE)    240.50980

                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
      SOURCE OF VARIATION       D.F.      SUM OF         MEAN          F
                                          SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............  22     7799.79919     354.53633     23.4951
DEVIATION ABOUT REGRESSION...  584     8812.42542      15.08977
                     TOTAL...  606    16612.22461

VARIABLE      MEAN        STD.         REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.   T VALUE     CORR. COE.      ADDED        CUM.
   1       416.32718     4.93224     0.42562     0.03571     11.91938     0.44235     5474.03857     0.32952
   3        21.45881     2.11722     0.00613     0.09419      0.06504     0.00269       48.52979     0.00292
   4         2.27103     1.45005    -0.25327     0.10590     -2.39155    -0.09648       17.13800     0.00103
   5        30.73558     8.96041     0.12891     0.02071      6.22541     0.24946      569.58832     0.03429
   6        26.04237     4.88884    -0.17292     0.04594     -3.76387    -0.15389       59.40051     0.00358
   7         6.11236     1.00630    -0.54442     0.18207     -2.99011    -0.12280      277.59330     0.01671
   8        11.39550     4.15893     0.04034     0.04753      0.85922     0.03553       11.36097     0.00068
  11        37.77430    11.17928     0.03723     0.01830      2.03447     0.08389      130.09356     0.00783
  12        79.58600    30.42367     0.05297     0.00810      6.54238     0.26132      643.53469     0.03874
  13        14.77720    20.56661    -0.02270     0.00964     -2.35620    -0.09704       32.60042     0.00196
  14        22.01450    20.38073    -0.00829     0.00895     -0.92519    -0.03826       11.42104     0.00069
  15        26.71049    21.23446    -0.03923     0.00945     -4.15334    -0.16938      236.35752     0.01423
  16        13.95404    14.15478    -0.01778     0.01284     -1.38478    -0.05721       25.10056     0.00151
  17         5.83522     8.88145    -0.00085     0.02338     -0.03652    -0.00151        0.22014     0.00001
  18         4.45667     7.20441     0.06150     0.02499      2.46092     0.10131      115.25284     0.00694
  19         5.30089     2.83919    -0.17046     0.06718     -2.53732    -0.10442       73.52483     0.00443
  20         7.73688     2.41868    -0.08391     0.08256     -1.01637    -0.04202       40.59007     0.00244
  21         2.87549     1.24918     0.07286     0.14950      0.48734     0.02016        0.82217     0.00005
  22         2.76608     1.58451     0.16674     0.11404      1.46214     0.06039       29.04746     0.00175
  23         2.82846     1.63694     0.02705     0.10553      0.25632     0.01061        1.02407     0.00006
  24         2.58858     1.26319     0.01274     0.13136      0.09698     0.00401        0.13647     0.00001
  25         2.33169     0.41318    -0.16176     0.40378     -0.40062    -0.01658        2.42189     0.00015
   2       416.30313     5.23573

COMP. CHECK ON FINAL COEFF.          -0.16176
VARIABLES DELETED...   9 10
```

Table 8.15 Regression Analysis of CRT-4, TA 4 on Full Model Including Pre-CAT and CRT 4, TA 1

```
SAMPLE SIZE     607
NO. OF VARIABLES 24      NO. OF VARIABLES DELETED  1  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  2

COEFFICIENT OF DETERMINATION  0.5578
MULTIPLE CORR. COEFFICIENT    0.7469

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       9266.64396
SUM OF SQUARES OF DEVIATION FROM REGRESSION     7345.58065

VARIANCE OF ESTIMATE       12.59962
STD. ERROR OF ESTIMATE      3.54959

INTERCEPT (A VALUE)   276.90092

              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
      SOURCE OF VARIATION       D.F.      SUM OF          MEAN         F
                                          SQUARES         SQUARES      VALUE
DUE TO REGRESSION............    23     9266.64396      402.89756    31.9770
DEVIATION ABOUT REGRESSION...   583     7345.58065       12.59962
                     TOTAL...   606    16612.22461

VARIABLE      MEAN        STD.         REG.      STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.    T VALUE     CORR. COE.     ADDED        CUM.
   1      416.32718      4.99224     0.30914     0.03437      8.99473      0.34909     5474.03857    0.32952
   3       21.45881      2.11722    -0.09848     0.08660     -1.13713     -0.04704       48.52979    0.00292
   4        2.27183      1.85005    -0.28094     0.09680     -2.90214     -0.11934       17.13800    0.00103
   5       30.73558      8.96041     0.06262     0.01993      3.14759      0.12927      569.58832    0.03429
   6       26.93237      4.88084    -0.14968     0.04204     -3.56089     -0.14590       59.40051    0.00358
   7        6.11236      1.00630    -0.62611     0.16655     -3.75939     -0.15384      277.59330    0.01671
   8       11.39550      4.15893     0.00057     0.04359      0.01308      0.00054       11.36097    0.00068
   9      409.73591     48.33211     0.04239     0.00393     10.76980      0.40799     2108.43906    0.12692
  11       37.77430     11.17928     0.03479     0.01672      2.08050      0.08585       29.05060    0.00175
  12       70.58600     30.42367     0.02858     0.00774      3.69467      0.15126      152.41134    0.00917
  13       14.79720     20.56561    -0.01646     0.00882     -1.86496     -0.07701       20.11798    0.00121
  14       22.01450     20.38073    -0.00178     0.00820     -0.21681     -0.00398        0.89751    0.00005
  15       26.73049     21.23446    -0.03328     0.00865     -3.84802     -0.15738      156.53113    0.00942
  16       13.95404     14.15478    -0.02163     0.01174     -1.84267     -0.07609       41.31952    0.00249
  17        5.49522      8.88145     0.00307     0.02137      0.14349      0.00594        6.79537    0.00041
  18        4.45667      7.28441     0.08110     0.02291      3.54020      0.14507      193.27761    0.01163
  19        5.30069      2.83919    -0.15628     0.06140     -2.54519     -0.10483       79.79513    0.00480
  20        7.73668      2.41868    -0.01106     0.07574     -0.14604     -0.00605        2.62604    0.00016
  21        2.87649      1.24918     0.09661     0.13661      0.63399      0.02625        2.55694    0.00015
  22        2.76608      1.68451     0.09694     0.10441      0.92849      0.03843        8.36670    0.00050
  23        2.82845      1.63694     0.01303     0.09644      0.13510      0.00560        0.20406    0.00001
  24        2.53858      1.26319     0.08211     0.12021      0.68309      0.02828        5.87095    0.00035
  25        2.33169      0.41318    -0.08910     0.36902     -0.24145     -0.01000        0.73456    0.00004
   2      416.30313      5.23573

COMP. CHECK ON FINAL COEFF.        -0.08910

VARIABLES DELETED... 10
```

Table 8.16 Regression Analysis of CRT-4 TA 4 on Full Model Including Pre-CAT

```
SAMPLE SIZE      607
NO. OF VARIABLES 23      NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  2

COEFFICIENT OF DETERMINATION  0.4965
MULTIPLE CORR. COEFFICIENT    0.7046

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION        8247.26827
SUM OF SQUARES OF DEVIATION FROM REGRESSION      8364.95634

VARIANCE OF ESTIMATE        14.32356
STD. ERROR OF ESTIMATE       3.78465

INTERCEPT.(A VALUE)   402.17411

                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
        SOURCE OF VARIATION        D.F.      SUM OF         MEAN          F
                                            SQUARES        SQUARES       VALUE
DUE TO REGRESSION............   22       8247.26827     374.87583    26.1720
DEVIATION ABOUT REGRESSION...  584       8364.95634      14.32356
                     TOTAL...  606      16612.22461

VARIABLE      MEAN        STD.        REG.      STD.ERROR    COMPUTED     PARTIAL     SUM OF SQ.   PROP. VAR.
  NO.                  DEVIATION     COEFF.   OF REG.COE.    T VALUE    CORR. COE.     ADDED         CUM.
   3       21.45881     2.11722    -0.10850     0.09233     -1.17518    -0.04857     203.45369     0.01225
   4        2.27163     1.85005    -0.29148     0.10321     -2.82422    -0.11608      11.74733     0.00071
   5       30.73558     8.95041     0.07490     0.02116      3.53941     0.14492    1412.76536     0.08504
   6       26.04237     4.88884    -0.17992     0.04464     -4.02738    -0.16439      56.71446     0.00341
   7        6.11236     1.00630    -0.77455     0.17670     -4.38341    -0.17847     697.41843     0.04198
   8       11.38550     4.15893     0.01389     0.04645      0.29910     0.01238      21.64561     0.00130
   9      409.73591    48.33211     0.05349     0.00398     13.45034     0.48633    4614.50490     0.27778
  11       37.77430    11.17928     0.04209     0.01781      2.36366     0.09734      50.07811     0.00301
  12       70.53600    30.42367     0.03737     0.00818      4.56712     0.18570     309.37320     0.01862
  13       14.79720    20.56661    -0.02343     0.00937     -2.49976    -0.10289      34.82636     0.00210
  14       22.31450    20.38073    -0.00392     0.00874     -0.44907    -0.01858       4.49937     0.00027
  15       26.70049    21.23446    -0.04774     0.00906     -5.26799    -0.21299     366.98442     0.02209
  16       13.95404    14.15478    -0.02669     0.01250     -2.13525    -0.08801      66.27137     0.00399
  17        5.89522     8.83145     0.01935     0.02270      0.85237     0.03525      23.03250     0.00139
  18        4.45667     7.23441     0.08891     0.02441      3.64278     0.14906     230.04511     0.01385
  19        5.30089     2.83919    -0.19081     0.06534     -2.92032    -0.11997     131.86146     0.00794
  20        7.73689     2.41868     0.00438     0.08074      0.05429     0.00225       0.15755     0.00001
  21        2.87649     1.24918    -0.00146     0.14529     -0.01008    -0.00042       0.22037     0.00001
  22        2.76698     1.68451     0.06937     0.11127      0.62343     0.02579       4.18798     0.00025
  23        2.82046     1.63694     0.05539     0.10270      0.53936     0.02231       4.04174     0.00024
  24        2.53858     1.26319     0.06275     0.12815      0.48966     0.02026       3.43395     0.00021
  25        2.33169     0.41318    -0.00734     0.39334     -0.01866    -0.00077       0.00499     0.00000
   2      416.30313     5.23573

COMP. CHECK ON FINAL COEFF.         -0.00734

VARIABLES DELETED...  1 10
```

Table 8.17 Regression Analysis of Post-CAT on Full Model Including CRT-4, TA 1

```
SAMPLE SIZE      607
NO. OF VARIABLES 23       NO. OF VARIABLES DELETED  2   (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO. 10

COEFFICIENT OF DETERMINATION  0.4583
MULTIPLE CORR. COEFFICIENT    0.6770

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      628194.30335
SUM OF SQUARES OF DEVIATION FROM REGRESSION    742533.81771

VARIANCE OF ESTIMATE     1271.46202
STD. ERROR OF ESTIMATE     35.65757

INTERCEPT (A VALUE)  -990.18220

                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.       SUM OF          MEAN            F
                                            SQUARES         SQUARES         VALUE
DUE TO REGRESSION............     22    628194.30335    28554.28652     22.4578
DEVIATION ABOUT REGRESSION...    584    742533.81771     1271.46202
                     TOTAL...    606   1370728.12109

VARIABLE     MEAN          STD.          REG.       STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                    DEVIATION      COEFF.     OF REG.COE.    T VALUE     CORR. COE.      ADDED          CUM.
   1      416.32718      4.99224       3.10296      0.32778       9.46667      0.36475    327131.74648     0.23866
   3       21.45881      2.11722       2.82465      0.86448       3.26746      0.13399     11548.99373     0.00843
   4        2.27183      1.85005       2.07055      0.97210       2.12996      0.08780     62184.16746     0.04537
   5       39.73558      8.95041       1.53336      0.19008       8.06680      0.31663     95604.22755     0.06975
   6       26.08237      4.88884      -0.01091      0.42171      -0.02586     -0.00107     21496.72635     0.01568
   7        6.11236      1.00630       0.14371      1.67131       0.08598      0.00356       545.62305     0.00040
   8       11.38550      4.15893       0.47062      0.43629       1.07871      0.04459      5792.57456     0.00423
  11       37.77430     11.17928       0.07714      0.16796       0.45931      0.01900      8478.62827     0.00619
  12       73.53600     30.42367       0.48081      0.07432       6.46929      0.25360     65239.03774     0.04759
  13       14.73720     20.56661      -0.15719      0.08845      -1.77712     -0.07334      3581.75696     0.00261
  14       22.01450     20.38073      -0.13264      0.08212      -1.61526     -0.06669      4732.86381     0.00345
  15       26.70049     21.23446      -0.00767      0.08671      -0.08842     -0.00366       153.53096     0.00011
  16       13.95404     14.15478      -0.03366      0.11787      -0.28562     -0.01182        25.53206     0.00002
  17        5.89522      8.38145      -0.42235      0.21452      -1.96787     -0.08115      6289.97272     0.00459
  18        4.45667      7.28441       0.40467      0.22941       1.76401      0.07280      2920.24182     0.00213
  19        5.33089      2.83919       0.49094      0.61666       0.79612      0.03293      1591.86009     0.00116
  20        7.73838      2.41868      -1.04523      0.75785      -1.37920     -0.05698      3060.18571     0.00223
  21        2.87649      1.24918      -2.03005      1.37229      -1.47931     -0.06110      2304.44217     0.00168
  22        2.76608      1.68451      -0.19862      1.04682      -0.18974     -0.00785        37.80694     0.00003
  23        2.82846      1.63694       0.02652      0.96867       0.02738      0.00113         6.53978     0.00000
  24        2.58858      1.26319      -2.32459      1.20581      -1.92782     -0.07952      4736.41967     0.00346
  25        2.33163      0.41318      -2.81116      3.70640      -0.75846     -0.03137       731.42533     0.00053
  10      425.93740     47.55973

COMP. CHECK ON FINAL COEFF.          -2.81116
VARIABLES DELETED...   2  9
```

Table 8.18 Regression Analysis of Post-CAT Full Model Including Pre-CAT

```
SAMPLE SIZE      607
NO. OF VARIABLES 23       NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO. 10

COEFFICIENT OF DETERMINATION  0.6468
MULTIPLE CORR. COEFFICIENT    0.8042

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      886575.83132
SUM OF SQUARES OF DEVIATION FROM REGRESSION    484152.28977

VARIANCE OF ESTIMATE       829.02789
STD. ERROR OF ESTIMATE      28.79284

INTERCEPT (A VALUE)    117.33722

               ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
       SOURCE OF VARIATION        D.F.      SUM OF          MEAN          F
                                             SQUARES        SQUARES      VALUE
DUE TO REGRESSION.............   22    886575.83132    40298.90142    48.6098
DEVIATION ABOUT REGRESSION...   584    484152.28977      829.02789
                     TOTAL...   606   1370728.12109

VARIABLE     MEAN         STD.         REG.      STD.ERROR     COMPUTED     PARTIAL     SUM OF SQ.    PROP. VAR.
  NO.                   DEVIATION     COEFF.   OF REG.COE.    T VALUE    CORR. COE.      ADDED         CUM.
   3       21.45681      2.11722     1.32607     0.70241      1.88788     0.07784     26769.79929    0.01953
   4        2.27183      1.85005     1.63617     0.78517      2.08383     0.08591     93517.77251    0.06822
   5       30.73550      8.96041     0.67328     0.16100      4.18197     0.17052    165006.80561    0.12038
   6       26.08737      4.88384     0.16570     0.33988      0.48753     0.02017     21852.81394    0.01594
   7        6.11236      1.00630    -1.70341     1.34430     -1.26714    -0.05236      2025.02407    0.00148
   8       11.33550      4.15893    -0.02357     0.35338     -0.06671    -0.00276      7275.81993    0.00531
   9      409.73591     48.33211     0.64116     0.03025     21.19229     0.65933    535070.39785    0.39035
  11       37.77430     11.17928     0.07850     0.13547      0.57943     0.02397       428.73360    0.00031
  12       70.58600     30.42367     0.18494     0.06225      2.97096     0.12202     10540.23663    0.00769
  13       14.79720     20.56661    -0.10412     0.07130     -1.46024    -0.06032      2397.96133    0.00175
  14       22.01450     20.38073    -0.05245     0.06646     -0.79522    -0.03289      1613.95282    0.00118
  15       25.70049     21.23446     0.00528     0.06894      0.07656     0.00317         3.54172    0.00000
  16       13.95404     14.15478    -0.11141     0.09511     -1.17136    -0.04841       531.99576    0.00039
  17        5.89522      8.88145    -0.28963     0.17271     -1.67698    -0.06923      1506.08898    0.00110
  18        4.45667      7.28441     0.71402     0.18569      3.84518     0.15714     10840.18626    0.00791
  19        5.30039      2.83919     0.52133     0.49708      1.04878     0.04336       506.59942    0.00037
  20        7.73684      2.41868     0.03921     0.61424      0.06384     0.00264       267.31880    0.00020
  21        2.87649      1.24918    -2.26324     1.10530     -2.04763    -0.08443      2360.35287    0.00172
  22        2.76608      1.68451    -1.29914     0.84655     -1.53464    -0.05338      2020.56765    0.00147
  23        2.82846      1.63694     0.03602     0.78132      0.04610     0.00191         5.07953    0.00000
  24        2.58858      1.28319    -1.45591     0.97491     -1.49338    -0.06169      1850.68074    0.00135
  25        2.33169      0.41318    -1.41017     2.99244     -0.47124    -0.01950       184.10238    0.00013
  10      425.93740     47.55973

COMP. CHECK ON FINAL COEFF.        -1.41017
VARIABLES DELETED...  1  2
```

Table 8.19 Regression Analysis of CRT-5, TA 4 on Full Model Including CRT-5, TA 1

```
SAMPLE SIZE      497
NO. OF VARIABLES 23        NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  2

COEFFICIENT OF DETERMINATION  0.5751
MULTIPLE CORR. COEFFICIENT    0.7584

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       11578.38473
SUM OF SQUARES OF DEVIATION FROM REGRESSION      8553.13676

VARIANCE OF ESTIMATE       18.04459
STD. ERROR OF ESTIMATE      4.24789

INTERCEPT (A VALUE)   128.23551

               ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
      SOURCE OF VARIATION     D.F.      SUM OF        MEAN        F
                                        SQUARES       SQUARES     VALUE
DUE TO REGRESSION............   22    11578.38473    526.29021   29.1661
DEVIATION ABOUT REGRESSION...  474     8553.13676     18.04459
                     TOTAL...  496    20131.52148

VARIABLE     MEAN        STD.       REG.     STD.ERROR     COMPUTED     PARTIAL     SUM OF SQ.   PROP. VAR.
  NO.                 DEVIATION    COEFF.   OF REG.COE.    T VALUE     CORR. COE.     ADDED        CUM.
   1      518.16901    5.66171    0.55591    0.04132     13.45533     0.52572    9489.03300    0.47135
   3       22.22374    1.65110   -0.06234    0.13343     -0.46719    -0.02145      29.90709    0.00149
   4        2.73672    1.80913    0.02357    0.12226      0.19278     0.00885       0.26000    0.00001
   5       32.97485    8.87728    0.04339    0.02420      1.79317     0.08209      46.26971    0.00230
   6       27.17505    5.30098   -0.17675    0.04950     -3.57034    -0.16185     404.07823    0.02007
   7        6.21408    1.02322   -0.38851    0.24978     -1.55542    -0.07126     174.49256    0.00867
   8       10.57143    3.88694    0.06673    0.06139      1.08695     0.04986      70.44488    0.00350
  11       38.88068   11.16114    0.02948    0.02135      1.38071     0.06329      27.46835    0.00136
  12       81.18270   23.35796    0.00185    0.01213      0.15263     0.00701       0.93246    0.00005
  13       11.89517   16.18726   -0.01342    0.01646     -0.81546    -0.03743       1.80723    0.00009
  14       22.42354   20.71346   -0.02376    0.01192     -1.99283    -0.09115      76.73301    0.00381
  15       27.55915   21.74156   -0.05389    0.01149     -4.69023    -0.21060     350.33307    0.01740
  16       17.15594   17.16125   -0.00992    0.01387     -0.71493    -0.03282      42.29204    0.00210
  17        6.20382    8.38560    0.04844    0.02888      1.67700     0.07680      72.41036    0.00360
  18        4.42877    6.74318    0.00393    0.02825      0.13903     0.00639       0.81376    0.00004
  19        5.92057    2.83412   -0.24166    0.08235     -2.93451    -0.13359       1.40550    0.00007
  20        7.53598    2.55553   -0.39536    0.08876     -4.45410    -0.20043     510.63539    0.02536
  21        3.06473    1.35783    0.63431    0.17826      3.55845     0.16130     246.04652    0.01222
  22        2.72164    1.58473    0.07756    0.13575      0.57132     0.02623       7.98040    0.00040
  23        2.55428    1.18081   -0.11014    0.17474     -0.63032    -0.02894       6.43801    0.00032
  24        2.50487    1.06134   -0.19526    0.19241     -1.01482    -0.04656      18.58335    0.00092
  25        2.30260    0.00013   48.88870 1475.79993      0.03313     0.00152       0.01980    0.00000
   2      518.70423    6.37085

COMP. CHECK ON FINAL COEFF.        48.88870
VARIABLES DELETED...   9 10
```

Table 8.20 Regression Analysis of CRT 5, TA 4 on Full Model Including CRT-5, TA 1 and Pre CAT

```
SAMPLE SIZE      497
NO. OF VARIABLES 24      NO. OF VARIABLES DELETED  1  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  2

COEFFICIENT OF DETERMINATION  0.6132
MULTIPLE CORR. COEFFICIENT    0.7831

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       12344.37675
SUM OF SQUARES OF DEVIATION FROM REGRESSION      7787.14474

VARIANCE OF ESTIMATE         16.46331
STD. ERROR OF ESTIMATE        4.05750

INTERCEPT (A VALUE)   162.57465

                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
       SOURCE OF VARIATION      D.F.      SUM OF          MEAN          F
                                          SQUARES         SQUARES       VALUE
DUE TO REGRESSION............  23     12344.37675     536.71203     32.6005
DEVIATION ABOUT REGRESSION...  473     7787.14474      16.46331
                     TOTAL...  496    20131.52148

VARIABLE     MEAN          STD.        REG.       STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                    DEVIATION     COEFF.     OF REG.COE.   T VALUE      CORR. COE.      ADDED        CUM.
    1      518.16901     5.66171     0.43106      0.04350      9.90586      0.41461     9489.03300     0.47135
    3       22.22374     1.55110    -0.16790      0.12839     -1.30773     -0.06002       29.90709     0.00149
    4        2.78672     1.80913    -0.04263      0.11719     -0.36379     -0.01672        0.26000     0.00001
    5       32.97485     8.87728    -0.00752      0.02429     -0.30983     -0.01424       46.26971     0.00230
    6       27.17505     5.30098    -0.22412      0.04779     -4.69001     -0.21080      404.07823     0.02007
    7        6.21408     1.32372    -0.45549      0.23878     -1.90754     -0.08737      174.49256     0.00867
    8       10.57143     3.88694     0.04581      0.05872      0.78018      0.03585       70.44488     0.00350
    9      454.84769    45.02804     0.03766      0.00552      6.82109      0.29926      866.64020     0.84305
   11       38.88068    11.16114     0.01684      0.02048      0.82211      0.03777        5.26702     0.00326
   12       61.18270    23.35796    -0.01077      0.01174     -0.91740     -0.04214       29.65498     0.00147
   13       11.89517    16.18726    -0.00698      0.01575     -0.44333     -0.02038        0.11780     0.00001
   14       22.42354    20.71846    -0.02470      0.01139     -2.16860     -0.09922       86.52596     0.00430
   15       27.55915    21.74156    -0.05158      0.01098     -4.69773     -0.21113      303.65839     0.01508
   16       17.15594    17.16125    -0.01785      0.01330     -1.34136     -0.06158       67.46165     0.00335
   17        6.29382     8.38560     0.06206      0.02766      2.24338      0.10261      100.14532     0.00497
   18        4.42877     8.74318     0.00565      0.02698      0.20949      0.00963        0.60845     0.00003
   19        5.92057     2.83412    -0.16844      0.07933     -2.12167     -0.09709        2.45351     0.00012
   20        7.53598     2.55553    -0.38027      0.08481     -4.48371     -0.20191      454.87602     0.02260
   21        3.06473     1.35783     0.55899      0.17062      3.27618      0.14896      162.38931     0.00807
   22        2.72164     1.58473     0.21206      0.13116      1.61681      0.07414       45.79496     0.00227
   23        2.55428     1.13081    -0.03213      0.16739     -0.19202     -0.00883        0.49689     0.00002
   24        2.50487     1.06134    -0.08331      0.18445     -0.47876     -0.02201        3.77351     0.00019
   25        2.30260     0.00013    57.42428   1409.65447      0.04074      0.00187        0.02732     0.00000
    2      518.78423     6.37085

COMP. CHECK ON FINAL COEFF.        57.42428
VARIABLES DELETED... 10
```

Table 8.21 Regression Analysis of CRT-5, TA 4 on Full Model Including Pre-CAT

```
SAMPLE SIZE      497
NO. OF VARIABLES 23       NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  2

COEFFICIENT OF DETERMINATION  0.5329
MULTIPLE CORR. COEFFICIENT    0.7300

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      10727.91928
SUM OF SQUARES OF DEVIATION FROM REGRESSION     9403.60221

VARIANCE OF ESTIMATE       19.83882
STD. ERROR OF ESTIMATE      4.45408

INTERCEPT (A VALUE)    300.50881

              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
     SOURCE OF VARIATION         D.F.      SUM OF          MEAN           F
                                           SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............    22    10727.91928     487.63269     24.5797
DEVIATION ABOUT REGRESSION...    474     9403.60221      19.83882
                      TOTAL...   496    20131.52148

VARIABLE      MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL       SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.   T VALUE     CORR. COE.      ADDED         CUM.
   3        22.22374     1.65110    -0.31154     0.14003    -2.22476     -0.10166      334.47923     0.01661
   4         2.78672     1.80913    -0.07005     0.12860    -0.54473     -0.02501        4.65977     0.00023
   5        32.97465     8.87728    -0.01166     0.02666    -0.43731     -0.02008      419.49953     0.02084
   6        27.17505     5.30098    -0.38474     0.04935    -7.79661     -0.33714     2320.81891     0.11528
   7         6.21408     1.02322    -0.53272     0.26198    -2.03340     -0.09293      523.89333     0.02602
   8        10.57143     3.85694     0.08806     0.06429     1.36977      0.06279      312.05602     0.01550
   9       454.84769    45.02804     0.06068     0.00550    11.03645      0.45215     4038.41789     0.20060
  11        38.88068    11.16114     0.01711     0.02248     0.76109      0.03494       20.16390     0.00100
  12        81.18270    23.35796    -0.00442     0.01286    -0.34328     -0.01577       28.11613     0.00140
  13        11.89517    16.18726    -0.00088     0.01728    -0.05098     -0.00234       10.83381     0.00054
  14        22.42354    20.71846    -0.04073     0.01238    -3.29052     -0.14945      265.55668     0.01319
  15        27.55915    21.74156    -0.08022     0.01163    -6.89845     -0.30206      950.06081     0.04719
  16        17.15594    17.16125    -0.02813     0.01455    -1.93245     -0.08841      136.81812     0.00680
  17         6.20382     8.38560     0.09106     0.03019     3.01583      0.13721      127.42678     0.00633
  18         4.42877     8.74318    -0.01214     0.02956    -0.41058     -0.01886        6.75237     0.00034
  19         5.92057     2.83412    -0.18807     0.08712    -2.15878     -0.09867        8.71874     0.00043
  20         7.53598     2.55553    -0.57674     0.09052    -6.37127     -0.28086      973.17366     0.04834
  21         3.06473     1.35783     0.49768     0.18716     2.65890      0.12123      103.20792     0.00513
  22         2.72164     1.58473     0.35963     0.14305     2.51414      0.11472      131.76633     0.00655
  23         2.55428     1.18081    -0.13047     0.18333    -0.71164     -0.03267       10.35014     0.00051
  24         2.53487     1.06134     0.04691     0.20192     0.23230      0.01067        1.07069     0.00005
  25         2.30260     0.00013    94.20016  1547.42842     0.06088      0.00280        0.07352     0.00000
   2       518.70423     6.37085

COMP. CHECK ON FINAL COEFF.          94.20016
VARIABLES DELETED...  1 10
```

Table 8.22 Regression Analysis of Post-CAT on Full Model Including CRT-5, TA 1

```
SAMPLE SIZE      497
NO. OF VARIABLES 23        NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO. 10

COEFFICIENT OF DETERMINATION  0.3992
MULTIPLE CORR. COEFFICIENT    0.6318

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      493141.19927
SUM OF SQUARES OF DEVIATION FROM REGRESSION    742333.47845

VARIANCE OF ESTIMATE     1566.10438
STD. ERROR OF ESTIMATE     39.57404

INTERCEPT (A VALUE)  -900.49918

              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION        D.F.      SUM OF          MEAN           F
                                          SQUARES         SQUARES        VALUE
DUE TO REGRESSION............   22     493141.19927    22415.50906    14.3129
DEVIATION ABOUT REGRESSION...  474     742333.47845     1566.10438
                     TOTAL...  496    1235474.67773

VARIABLE     MEAN          STD.         REG.        STD.ERROR      COMPUTED     PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                    DEVIATION     COEFF.      OF REG.COE.     T VALUE     CORR. COE.       ADDED          CUM.
    1       518.16901     5.66171      3.44983       0.38490       8.96287      0.38068    171767.16180     0.13303
    3        22.22374     1.65110     -1.94791       1.24306      -1.56703     -0.07179     31219.03522     0.02527
    4         2.74672     1.80913      0.73302       1.13902       0.64355      0.02955     51233.23319     0.04147
    5        32.97485     8.87728      1.27257       0.22541       5.64561      0.25101     72020.14148     0.05829
    6        27.17505     5.30098      2.49408       0.46113       5.40863      0.24110     77208.13583     0.06249
    7         6.21408     1.02322      0.46783       2.32697       0.20105      0.00923      9540.56708     0.00772
    8        10.57143     3.38694      0.28819       0.57191       0.50390      0.02314      1657.21039     0.00134
   11        39.88068    11.16114      0.49845       0.19892       2.50572      0.11434      9068.61582     0.00734
   12        81.18270    23.35796      0.40856       0.11304       3.61432      0.16377     22103.41004     0.01789
   13        11.89517    16.18726      0.04662       0.15335       0.30402      0.01396       111.39099     0.00009
   14        22.42354    20.71846      0.28832       0.11108       2.59555      0.11838      6539.16238     0.00529
   15        27.55915    21.74156     -0.03672       0.10705      -0.34301     -0.01575      2764.49647     0.00224
   16        17.15594    17.16125      0.19617       0.12922       1.51812      0.06955      1310.77324     0.00106
   17         6.20382     8.33560     -0.58098       0.26909      -2.15908     -0.09863       730.34889     0.00059
   18         4.42877     8.74318      0.70607       0.26319       2.68290      0.12230     14802.99453     0.01198
   19         5.92057     2.83412     -1.01939       0.76721      -1.32740     -0.06085      1014.66066     0.00082
   20         7.53598     2.55553      0.69249       0.82692       0.83743      0.03844       751.32731     0.00061
   21         3.06473     1.35783      2.55438       1.66065       1.53818      0.07048      7021.38606     0.00568
   22         2.72164     1.58473     -3.06287       1.26468      -2.42186     -0.11056      8308.80873     0.00673
   23         2.55428     1.18081     -2.53179       1.62792      -1.55523     -0.07125      3729.99294     0.00302
   24         2.50487     1.06134     -0.69859       1.79249      -0.38973     -0.01790       237.87988     0.00019
   25         2.30260     0.00013   -237.2442013748.78441       -0.01726     -0.00079         0.46632     0.00000
   10       467.17002    49.90868

COMP. CHECK ON FINAL COEFF.      -237.24420
VARIABLES DELETED...  2  9
```

Table 8.23 Regression Analysis of Post-CAT on Full Model Including Pre-CAT

```
SAMPLE SIZE      497
NO. OF VARIABLES 23        NO. OF VARIABLES DELETED  2  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO. 10

COEFFICIENT OF DETERMINATION  0.6025
MULTIPLE CORR. COEFFICIENT    0.7762

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       744377.21136
SUM OF SQUARES OF DEVIATION FROM REGRESSION     491097.46637

VARIANCE OF ESTIMATE     1036.07060
STD. ERROR OF ESTIMATE     32.18805

INTERCEPT (A VALUE)    99.48669

              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
      SOURCE OF VARIATION         D.F.       SUM OF          MEAN          F
                                             SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............     22    744377.21136   33835.32779    32.6574
DEVIATION ABOUT REGRESSION...     474    491097.46637    1036.07060
                      TOTAL...    496   1235474.67773

VARIABLE      MEAN          STD.        REG.       STD.ERROR    COMPUTED      PARTIAL       SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION     COEFF.    OF REG.COE.    T VALUE     CORR. COE.        ADDED         CUM.
   3        22.22374      1.65110    -4.28141      1.01197     -4.23075     -0.19076      52848.84203     0.04278
   4         2.78672      1.80913    -0.56494      0.92937     -0.60788     -0.02791      54279.90866     0.04393
   5        32.97485      8.87728     0.31917      0.19254      1.65636      0.07599     102801.51784     0.08321
   6        27.17505      5.30098     1.19293      0.35661      3.34516      0.15187      25151.60259     0.02036
   7         6.21408      1.02322    -0.97613      1.89326     -0.51558     -0.02367       2371.25287     0.00192
   8        10.57143      3.88694     0.01254      0.46458      0.02699      0.00124       7878.44611     0.00638
   9       454.84769     45.02804     0.75794      0.03973     19.07666      0.65902     471850.81433     0.38192
  11        38.88068     11.16114     0.26508      0.16246      1.63161      0.07473       1859.09066     0.00150
  12        81.18270     23.35796     0.19172      0.09297      2.06229      0.09433        919.73698     0.00074
  13        11.89517     16.18726     0.18196      0.12486      1.45729      0.06679       1209.79923     0.00098
  14        22.42354     20.71846     0.22862      0.08944      2.55605      0.11660       3440.16804     0.00278
  15        27.55915     21.74156    -0.06961      0.08404     -0.82833     -0.03802       2977.38566     0.00241
  16        17.15594     17.16125     0.02222      0.10518      0.21124      0.00970          2.49[illegible]     0.00000
  17         6.20382      8.38560    -0.25229      0.21821     -1.15620     -0.05303          4.98039     0.00000
  18         4.42877      8.74318     0.69104      0.21359      3.23530      0.14699      12681.30548     0.01026
  19         5.92957      2.83412     0.28530      0.62951      0.45313      0.02081        390.78181     0.00032
  20         7.53598      2.55553     0.45279      0.65417      0.69215      0.03178        721.94100     0.00058
  21         3.05473      1.35783     0.99811      1.35266      0.73788      0.03387        482.24560     0.00039
  22         2.72164      1.58473    -0.18322      1.03374     -0.17724     -0.00814         21.99404     0.00002
  23         2.55428      1.18081    -1.34721      1.32486     -1.01687     -0.04666       1177.72619     0.00095
  24         2.50487      1.06134     1.63843      1.45923      1.12281      0.05150       1306.16940     0.00166
  25         2.39260      0.00013    17.8954311182.71588      0.00160      0.00007          0.00265     0.00000
  10       467.17002     49.90868

COMP. CHECK ON FINAL COEFF.          17.89543
VARIABLES DELETED...   1  2
```

Table 8.24 Raw Regression Estimates of Criterion- and Norm-Referenced Performances in Basic Explanatory Model

Explanatory Variables	CRT Level 2 N=153	CRT Level 3 N=320	CRT Level 4 N=441	CRT Level 5 N=436	CAT N=2231
	Outcome Measure				
Quality of Instruction					
mpw Whole Group Teacher	.003	.009***	.002	.002	- .000
mpw Small Group Teacher	.005	.002	.003	- .002	.002
mpw Individual Instruction Teacher	.006	.012	.001	- .001	.001
mpw Small Group Specialist	.009	.008	.049	.016	- .046**
mpw Individual Instruction Teacher	.002	- .002	- .009*	.013	- .013*
mpw Small Group Paid Aide	- .002	- .002	- .032**	- .007	- .021*
mpw Total Individual Help	- .002	- .001	- .010	.021	- .020*
Student Data					
Age	.032	- .179	.072	- .159	.048
No. of Days Absent	- .038*	.007	.027	- .005	- .055**
Father's Occupation	- .016	.345	.285	.482**	1.516***
Pretest					
CRT Test Administration 1	.704***	.601***	.555***	.758***	.864***
Multiple R	.736	.597	.657	.779	.888
Multiple R^2	.541	.356	.432	.607	.789
F Value	15.14	15.45	29.70	59.56	756.20

* $p < .05$
** $p < .01$
*** $p < .001$

9.0 Studies of Curvilinearity and Curvilinear Interaction

Due to the complexity of the time effects experienced in the main regression analyses, detailed curvilinear and interaction studies of specific time variables were initiated.

Curvilinear time studies were designed to explore the linear and quadratic effects of each time variable with the California Achievement Test. The procedure involved successive multiple regression analyses in the following order:

1. Regression of Achievement on time (linear effect),
2. Regression of achievement on time and time squared (quadratic effect),
3. Regression of achievement on the full explanatory model variables including time (linear),
4. Regression of achievement on the full explanatory model variables including time and time squared (quadratic),

A key to the variables used in these regressions is included in Table 9.1.

The presence of a curvilinear effect was determined by testing the significance of the F-ratio between step 1 and step 2. A significant F-ratio between the linear and quadratic components indicated a curvilinear effect. In cases where there was no significant curvilinear effect, the F-ratio between zero and the linear component was tested for significance. A significant F-ratio indicated a linear effect, while a non-significant F-ratio indicated no effect of that time variable on achievement.

For significant effects, a regression equation was solved and plotted using raw regression coefficients. A clarification of the stability of the significant time effects was provided in step 3 and 4 when each effect was included in the full explanatory model. The regression analyses of the significant time variables (alone and within the full explanatory model) and the plots of their regression equations are included in Tables 9.2 through 9.21 and Figures Figures 9.1 through 9.10.

The regression equation used to plot the significant curvilinear time effects was of the general form:

$$Y = a_0 + a_1X + a_2X^2$$

where

Y = California Achievement Test (ADSS),

X = instructional time in minutes per year X .01,

a_0 = y-intercept,

a_1 and a_2 = raw regression coefficients

It was determined that instructional time might have a different effect on students with differing ability. Due to the possible curvilinear effect of time, a model for studying curvilinear interaction was required. This model took the following form:[1]

$$\text{(Model 1)}\ Y = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + E_1$$

where

Y = California Achievement Test (ADSS),

X_1 = 1 if the student was of high ability (scored above 467 on the pretest of the CAT); otherwise $X_1 = 0$,

X_2 = 1 if the student was of low ability (scored below 368 on the pretest of the CAT); otherwise $X_2 = 0$,

X_3 = instructional time X .01 for high ability students; otherwise $X_3 = 0$,

X_4 = instructional time X .01 for low ability students; otherwise $X_3 = 0$,

X_5 = squared elements in X_3,

---

[1] This model and subsequent testing procedure were derived from the same model suggested by F. Kelly, D. Beggs, K. McNeil, T. Eichelberger, and J. Lyon in Multiple Regression Approach, Southern Illinois University Press, Carbondale, 1969, pp.173-191.

X_6 = squared elements in X_4,

E_1 = the difference between the observed Y and predicted Y,

a_0 = y-intercept,

a_1, a_2, a_3, a_4, a_5, and a_6 = raw regression coefficients.

This model and reduced forms thereof provided a mechanism for studying the curvilinear interaction of instructional time by student pretest ability when using the California Achievement Test as the dependent variable. The mechanism involved a series of tests based on change in R^2 from model to model. These models and tests were performed in the following steps:

Step 1: Model 1 was tested to see if R^2 was significantly different from zero. If R^2 was significant, the possiblity of curvilinear interaction existed in the data.

Step 2: To determine whether the relationship between the instructional time variable and reading achievement was linear and different across ability, the R^2 of model 1 was compared with the R^2 of the following Model 2:

$$\text{(Model 2)} \quad Y_1 = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + E_2$$

It can be seen that Model 2 is actually Model 1 without the squared terms for instructional time within an ability group. A non-significant F-ratio between Model 1 and Model 2 indicated that the lines were linear which led directly to further tests in Steps 3 and 4 to determine the nature of the linear lines. A significant F-ratio between Model 1 and Model 2 indicated curvilinearity which required further testing for interaction or parallelism in Steps 5 and 6.

Step 3: If the lines were determined in step 2 to be linear, the R^2 of Model 2 (which allows the lines to be non-parallel), was compared with the R^2 of Model 3 (which allows the lines to be parallel):

$$(\text{Model } 3)\ Y_1 = a_0 + a_1X_1 + a_2X_2 + a_5Z_1 + E_3$$

where $Z_1 = X_3 + X_4$.

If the F-ratio between Model 2 and Model 3 was significant, the non-parallel lines were plotted using Model 2. A significant F-ratio ruled out non-parallel lines, leaving the possibility of parallel or superimposed lines to be tested in Step 4.

Step 4: Having ruled out non-parallel lines, Model 3 was compared with Model 4:

$$(\text{Model } 4)\ Y_1 = a_0 + a_1Z_1 + E_4.$$

A significant F-ratio between Model 3 and Model 4 indicated that the lines were parallel and Model 3 was plotted. An non-significant F-ratio indicated that the lines for each ability group were superimposed and one line plotted by Model 4 best described the data.

Step 5: As stated, a significant F-ratio between Model 1 and Model 2 indicated curved lines. In this case, Model 1 was then compared to Model 5:

$$(\text{Model } 5)\ Y_1 = a_0 + a_1X_1 + a_2X_2 + a_7Z_2 + a_8Z_3 + E_5$$

where $Z_2 = X_3 + X_4$ and $Z_3 = X_5 + X_6$.

A significant F-ratio between Model 1 and Model 5 indicated curvilinear interaction, and this interaction was plotted using Model 1. If, on the other hand, the F-ratio proved non-significant, the curved lines were either equidistant (parallel) or superimposed.

Step 6: Finally, Model 5 was compared with Model 6:

$$(\text{Model } 6)\ Y_1 = a_0 + a_2Z_1 + a_8Z_2 + E_6.$$

If the F-ratio between Model 5 and Model 6 was significant, two parallel curved lines were plotted using Model 5. If it was not significant, one curved line was the best fit and was plotted using Model 6.

A regression analysis based on these six models was computed on six different instructional time variables in all four school districts. The variables used in each model are summarized in Table 9.22. The regression analysis of the model of best fit for each time variable in each district is included together with its plot in Table 9.23 through 9.45 and Figures 9.11 through 9.33.

Table 9.1 Key to Variables Used in Curvilinear Regression Analyses by District

Variable Name	District			
	A	B	C	D
Student Achievement				
Post-test CAT Total Reading-ADSS	7	7	6	7
Student Characteristics				
Age in half-years	1	1	1	1
3rd Grade PEP Reading-Raw Score	2	2	-	2
Pretest CAT Total Reading-ADSS	6	6	5	6
Teacher Characteristics				
Degree Status	4	4	3	4
Age	12	17	14	13
Reading Class Structure				
Number of Pupils	3	3	2	3
% White Students	13	18	15	14
% Working Poor/Unskilled Worker	15	20	17	16
Instructional Materials				
IMRU	5	5	4	5
School Characteristics				
Dummy Variable for School 1	8	8	7	8
Dummy Variable for School 2	-	9	8	9
Dummy Variable for School 3	-	10	9	-
Dummy Variable for School 4	-	11	10	-
Dummy Variable for School 5	-	12	-	-
Dummy Variable for School 6	-	13	-	-
Instructional Time (minutes per year x .01)				
Total Individualized Instruction	9	14	11	10
Total Teacher Instructional Time	10	15	12	11
Total Specialist Instructional Time	11	16	13	12
Total Individualized Instruction Time Squared	16	21	18	17
Total Teacher Instructional Time Squared	17	22	19	18
Total Specialist Time Squared	18	23	20	19

Table 9.2 Regression Analysis of Reading Achievement on Total Teacher Instructional Time (Quadratic) in District A

```
SAMPLE SIZE      567
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 15  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.0113
MULTIPLE CORR. COEFFICIENT    0.1063

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       26329.38388
SUM OF SQUARES OF DEVIATION FROM REGRESSION  2304125.78405

VARIANCE OF ESTIMATE    4085.32940
STD. ERROR OF ESTIMATE    63.91658

INTERCEPT (A VALUE)   495.24409


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
      SOURCE OF VARIATION       D.F.      SUM OF          MEAN          F
                                          SQUARES        SQUARES      VALUE
DUE TO REGRESSION..............   2     26329.38388   13164.69194    3.2224
DEVIATION ABOUT REGRESSION...   564   2304125.78405    4085.32940
                      TOTAL...   566   2330455.16796


VARIABLE      MEAN        STD.         REG.       STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.     OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
  10        80.77147     27.16948    -1.05958     0.43549     -2.43306    -0.10192       95.95814     0.00004
  17      7260.50997   4180.41915     0.00717     0.00283      2.53404     0.10610    26233.42573     0.01126
   7       461.73739     64.16706

COMP. CHECK ON FINAL COEFF.          0.00717

VARIABLES DELETED...  1  2  3  4  5  6  8  9 11 12 13 14 15 16 18
```

Table 9.3 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Teacher Instructional Time (Quadratic) in District A

```
SAMPLE SIZE    567
NO. OF VARIABLES 13      NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7738
MULTIPLE CORR. COEFFICIENT    0.8797

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     1803402.61959
SUM OF SQUARES OF DEVIATION FROM REGRESSION    527052.54833

VARIANCE OF ESTIMATE      951.35839
STD. ERROR OF ESTIMATE     30.84410

INTERCEPT (A VALUE)     -9.40939


                   ANALYSIS OF VARIANCE FOR THE MULTIPLE
                           LINEAR  REGRESSION
        SOURCE OF VARIATION          D.F.      SUM OF          MEAN           F
                                               SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............  12  1803402.61959  150283.55163  157.9673
DEVIATION ABOUT REGRESSION...  554   527052.54833     951.35839
                    TOTAL...  566  2330455.15796


VARIABLE     MEAN         STD.       REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                   DEVIATION   COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED          CUM.
   1       21.77743     1.70530    1.02899     1.01864     1.01016      0.04288    242895.66450    0.10423
   2       32.93034    10.45460    0.49690     0.16483     3.01457      0.12704    738383.13966    0.31684
   3       30.97354     4.26229    0.00202     0.39365     0.00513      0.00122     41047.61805    0.01761
   4        6.84586     0.80283    2.69430     1.98856     1.35490      0.05747     28047.79933    0.01204
   5        9.14286     3.14306    0.42011     0.72215     0.58175      0.02471      1835.37574    0.00079
   6      441.91358    63.05991    0.79716     0.03010    26.47993      0.74742    734928.19526    0.31536
   8        0.57143     0.49531   -3.17433     3.51429    -0.90326     -0.03835      1598.73749    0.00069
  10       80.77147    27.16948   -0.13970     0.22461    -0.62196     -0.02642       731.23170    0.00031
  12       43.48677     9.60433    0.10984     0.19026     0.57730      0.02452       634.06462    0.00027
  13       89.03316     8.76642    0.63913     0.19812     3.22590      0.13679     11690.74363    0.00502
  15       25.97160    16.64773    0.10332     0.04752     1.05952      0.04497      1267.24887    0.00054
  17     7260.90497  4180.41915    0.00089     0.00149     0.60027      0.02549       342.80089    0.00015
   7      461.73739    64.16706

CONF. CHECK ON FINAL COEFF.          0.00089

VARIABLES DELETED...  9 11 14 16 18
```

Figure 9.1 Regression of Reading Achievement on Total Teacher Instructional Time (Quadratic) in District A

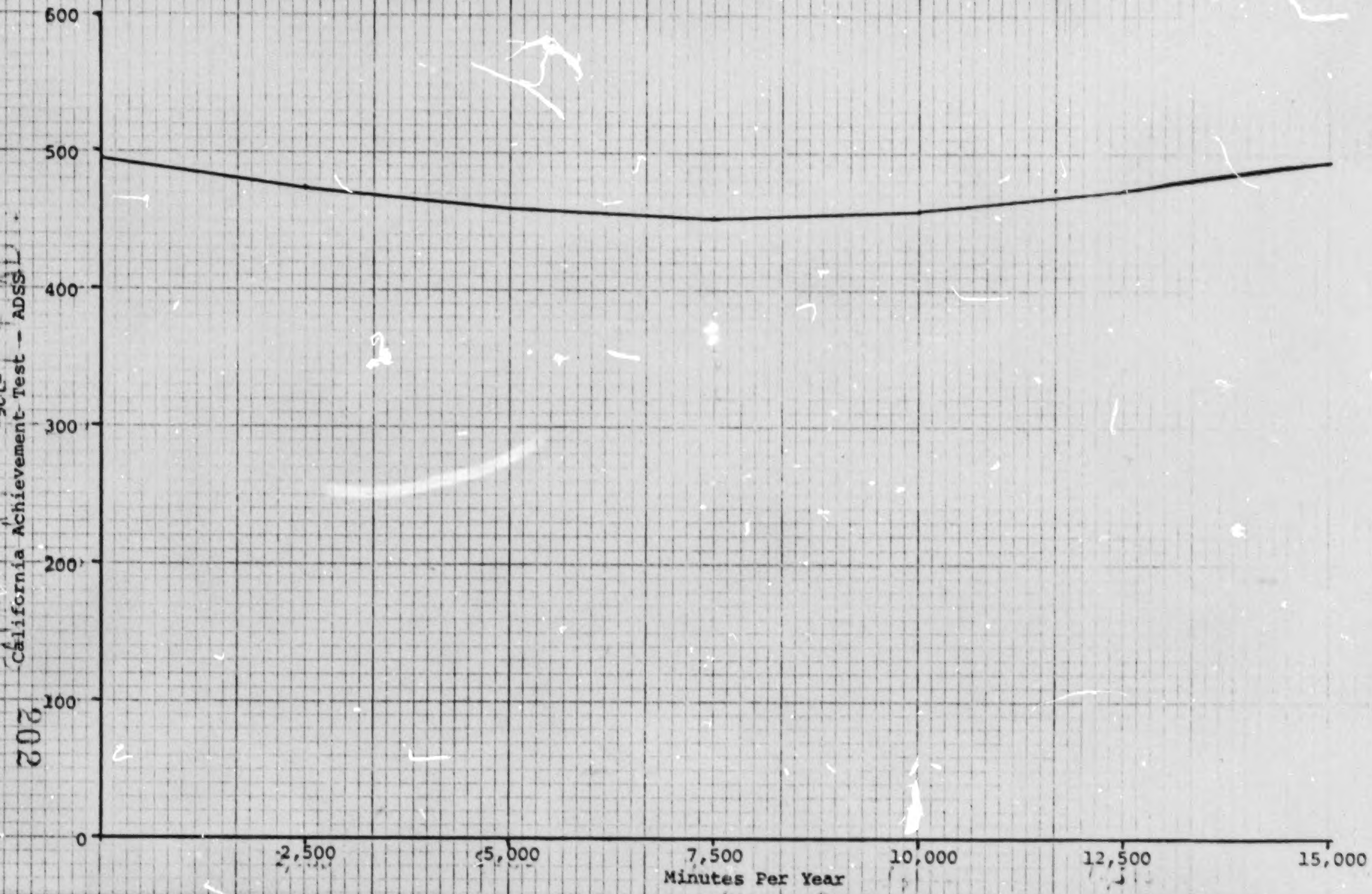


Table 9.4 Regression Analysis of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District A

```
SAMPLE SIZE    567
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 15  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.0363
MULTIPLE CORR. COEFFICIENT    0.1907

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       84707.59633
SUM OF SQUARES OF DEVIATION FROM REGRESSION   2245747.57165

VARIANCE OF ESTIMATE     3981.82194
STD. ERROR OF ESTIMATE     63.10168

INTERCEPT (A VALUE)   464.77871


                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
         SOURCE OF VARIATION      D.F.      SUM OF         MEAN        F
                                            SQUARES       SQUARES     VALUE
DUE TO REGRESSION............    2     84707.59633   42353.79816   10.6368
DEVIATION ABOUT REGRESSION...  564   2245747.57165    3981.82194
                     TOTAL...  566   2330455.16796


VARIABLE      MEAN        STD.        REG.      STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                  DEVIATION     COEFF.   OF REG.COE.    T VALUE    CORR. COE.      ADDED        CUM.
  11        0.84400     4.52704   -0.03124     1.61594     -3.73235    -0.15525    59903.26215    0.02570
  10       21.17026   188.64017    0.09679     0.03878      2.49588     0.10452    24804.33418    0.01064
   7      461.73739    64.16706

COMP. CHECK ON FINAL COEFF.        0.09679

VARIABLES DELETED...  1  2  3  4  5  6  8  9 10 12 13 14 15 16 17
```

Table 9.5 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Specialist Instructional Time (Quadratic) in District A

```
SAMPLE SIZE     567
NO. OF VARIABLES 13       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7740
MULTIPLE CORR. COEFFICIENT    0.8798

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    1803761.80471
SUM OF SQUARES OF DEVIATION FROM REGRESSION   526693.36322

VARIANCE OF ESTIMATE      950.71004
STD. ERROR OF ESTIMATE     30.83359

INTERCEPT (A VALUE)    -17.96787


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
       SOURCE OF VARIATION      D.F.      SUM OF        MEAN           F
                                          SQUARES      SQUARES        VALUE
DUE TO REGRESSION............  12   1803761.80471  150313.48373   158.1065
DEVIATION ABOUT REGRESSION...  554   526693.36322     950.71004
                     TOTAL...  566  2330455.16796


VARIABLE     MEAN        STD.        REG.      STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                  DEVIATION    COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED         CUM.
   1       21.77743     1.70530    1.06226     1.01508      1.04648     0.04442    242895.66450    0.10423
   2       32.93034    10.45460    0.50723     0.16559      3.06317     0.12935    738383.13966    0.31684
   3       30.97354     4.26229   -0.01629     0.38989     -0.04178    -0.00178     41047.61805    0.01761
   4        6.54586     0.80283    2.61364     1.99114      1.31264     0.05568     28047.79933    0.01204
   5        9.14286     3.14306    0.40056     0.69756      0.57422     0.02439      1835.37574    0.00079
   6      441.91358    63.05941    0.79964     0.03008     26.58257     0.74869    734928.19506    0.31536
   8        0.57143     0.49531   -3.71325     3.52576     -1.05318    -0.04470      1598.73749    0.00069
  11        0.84400     4.52704    0.45089     0.81563      0.55281     0.02348       708.46075    0.00030
  12       43.48077     9.60433    0.11730     0.18987      0.61776     0.02624       733.55787    0.00031
  13       89.03316     8.70642    0.66461     0.18089      3.67413     0.15423     12163.93843    0.00522
  15       25.97160    16.64773    0.11632     0.09645      1.20603     0.05117      1352.47885    0.00058
  18       21.17026   188.64017   -0.00513     0.01933     -0.26515    -0.01126        66.83886    0.00003
   7      461.73729    64.16706

COMP. CHECK ON FINAL COEFF.      -0.00513

VARIABLES DELETED...  9 10 14 16 17
```

Figure 9.2 Regression of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District A

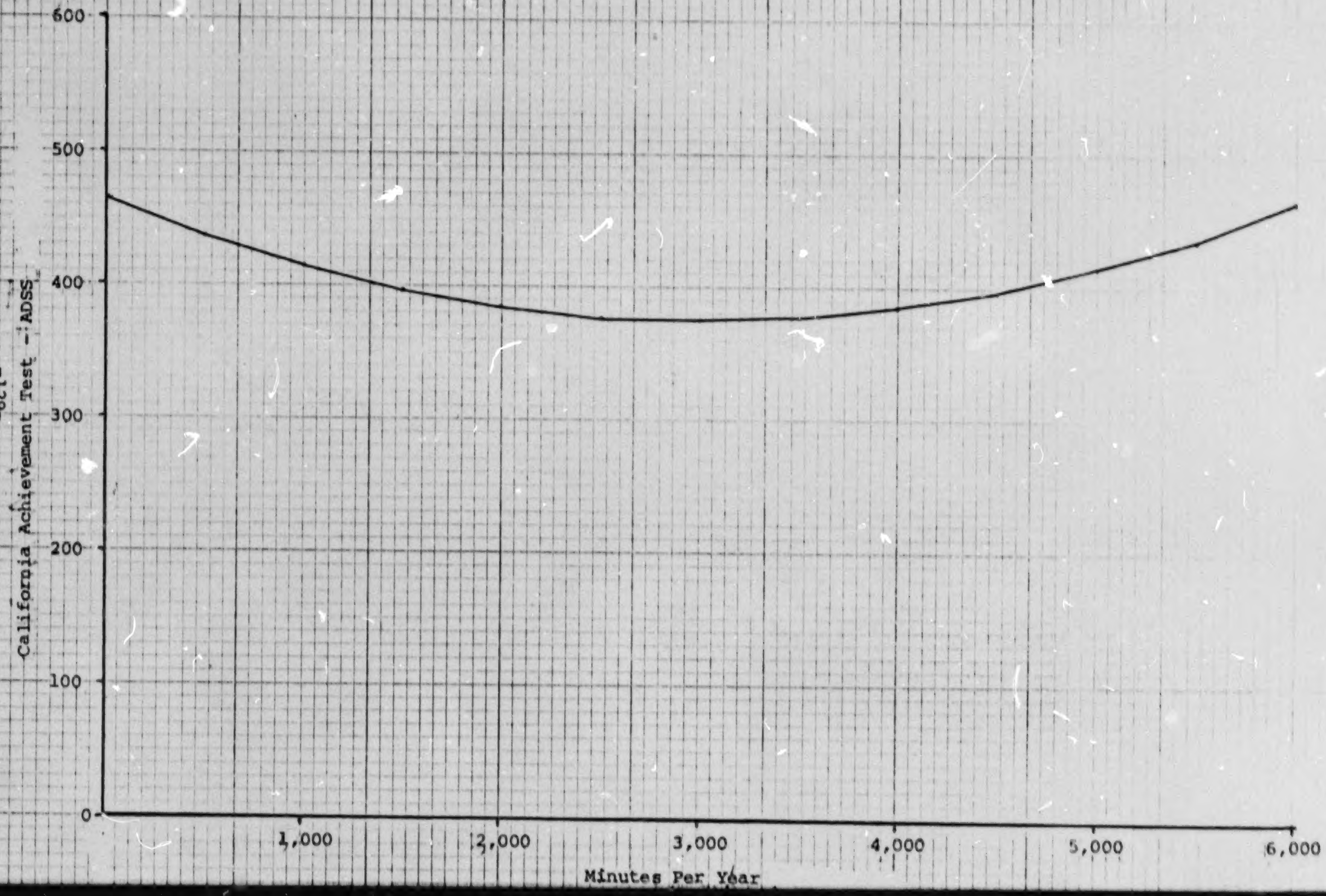


Table 9.6 Regression Analysis of Reading Achievement on Total Teacher Instructional Time (Quadratic) in District B

```
SAMPLE SIZE      947
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 20  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.0380
MULTIPLE CORR. COEFFICIENT    0.1950

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      186652.20797
SUM OF SQUARES OF DEVIATION FROM REGRESSION  4721070.50292

VARIANCE OF ESTIMATE     5001.13401
STD. ERROR OF ESTIMATE     70.71870

INTERCEPT (A VALUE)    434.01580


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION        D.F.       SUM OF          MEAN          F
                                          SQUARES        SQUARES      VALUE
DUE TO REGRESSION.............    2   186652.20797   93326.10399   18.6610
DEVIATION ABOUT REGRESSION...  944  4721070.50292    5001.13401
                     TOTAL...  946  4907722.71093


VARIABLE     MEAN        STD.        REG.      STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.  PROP. VAR.
  NO.                 DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.       ADDED        CUM.
  15       79.50016    43.98185    0.82479     0.13745      6.00066     0.19168      7469.46614    0.00152
  22     8252.63579 10230.50314   -0.00354     0.00059     -5.98568    -0.19122    179182.74182    0.03651
   7      440.39704    72.02685

COMP. CHECK ON FINAL COEFF.          -0.00354

VARIABLES DELETED...  1  2  3  4  5  6  8  9 10 11 12 13 14 16 17 18 19 20 21 23
```

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Table 9.7 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Teacher Instructional Time (Quadratic) in District B

```
SAMPLE SIZE      947
NO. OF VARIABLES 18       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7930
MULTIPLE CORR. COEFFICIENT     0.8905

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3891677.37756
SUM OF SQUARES OF DEVIATION FROM REGRESSION  1016045.33337

VARIANCE OF ESTIMATE      1093.69788
STD. ERROR OF ESTIMATE      33.07110

INTERCEPT (A VALUE)     35.53357


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
     SOURCE OF VARIATION           D.F.      SUM OF         MEAN          F
                                            SQUARES       SQUARES       VALUE
DUE TO REGRESSION............       17   3891677.37756  228922.19868   209.3103
DEVIATION ABOUT REGRESSION...      929   1016045.33337    1093.69788
                    TOTAL...       946   4907722.71093


VARIABLE     MEAN        STD.         REG.      STD.ERROR      COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                  DEVIATION     COFFF.    OF REG.COE.     T VALUE    CORR. COE.      ADDED         CUM.
   1       22.26000     1.99524     0.69378     0.64788       1.07385     0.03911      80563.10402    0.01642
   2       28.06938    10.23760     0.88082     0.14096       6.24891     0.20084    1941546.11132    0.39561
   3       24.61457     4.63696     0.15548     0.35833       0.43392     0.01423      47869.77804    0.00975
   4        6.00634     1.07536     0.34198     1.28135       0.26689     0.00876      93978.03054    0.01915
   5       11.32735     4.16044     0.30257     0.29596       1.02233     0.03352       3525.22133    0.00072
   6      430.21943    70.35534     0.79252     0.02183      36.30714     0.76586    1696917.66569    0.34576
   8        0.11088     0.31414    -4.32091     7.01310      -0.61612    -0.02021       7321.64492    0.00149
   9        0.19535     0.39668     0.05937     5.99371       0.10006     0.00525       6244.37879    0.00127
  10        0.06019     0.23796     9.39135     5.54988       1.69217     0.05543        847.53401    0.00017
  11        0.17951     0.38399     4.86279     4.49311       1.08228     0.03549       1288.31327    0.00026
  12        0.17212     0.37769     4.22486     4.33086       0.97553     0.03199        232.32737    0.00005
  13        0.07181     0.25933     8.97454     5.96699       1.50403     0.04929       4707.61167    0.00096
  15       79.50016    43.98185     0.15265     0.07360       2.07405     0.06789       3318.09046    0.00068
  17       39.04604    12.14516     0.07303     0.11278       0.62093     0.02037        225.21803    0.00005
  18       83.01943    18.15113     0.02932     0.13618       0.21529     0.00706        518.82998    0.00011
  20       37.22101    32.61469    -0.02949     0.06484      -0.45478    -0.01492         39.55038    0.00001
  22     8252.01579 10230.50314    -0.00052     0.00034      -1.52213    -0.04938       2533.96153    0.00052
   7      440.39704    72.02685

COMP. CHECK ON FINAL COEFF.          -0.00352

VARIABLES DELETED... 14 16 19 21 23
```

Figure 9.3 Regression of Reading Achievement on Total Teacher Instructional Time (Quadratic) in District B

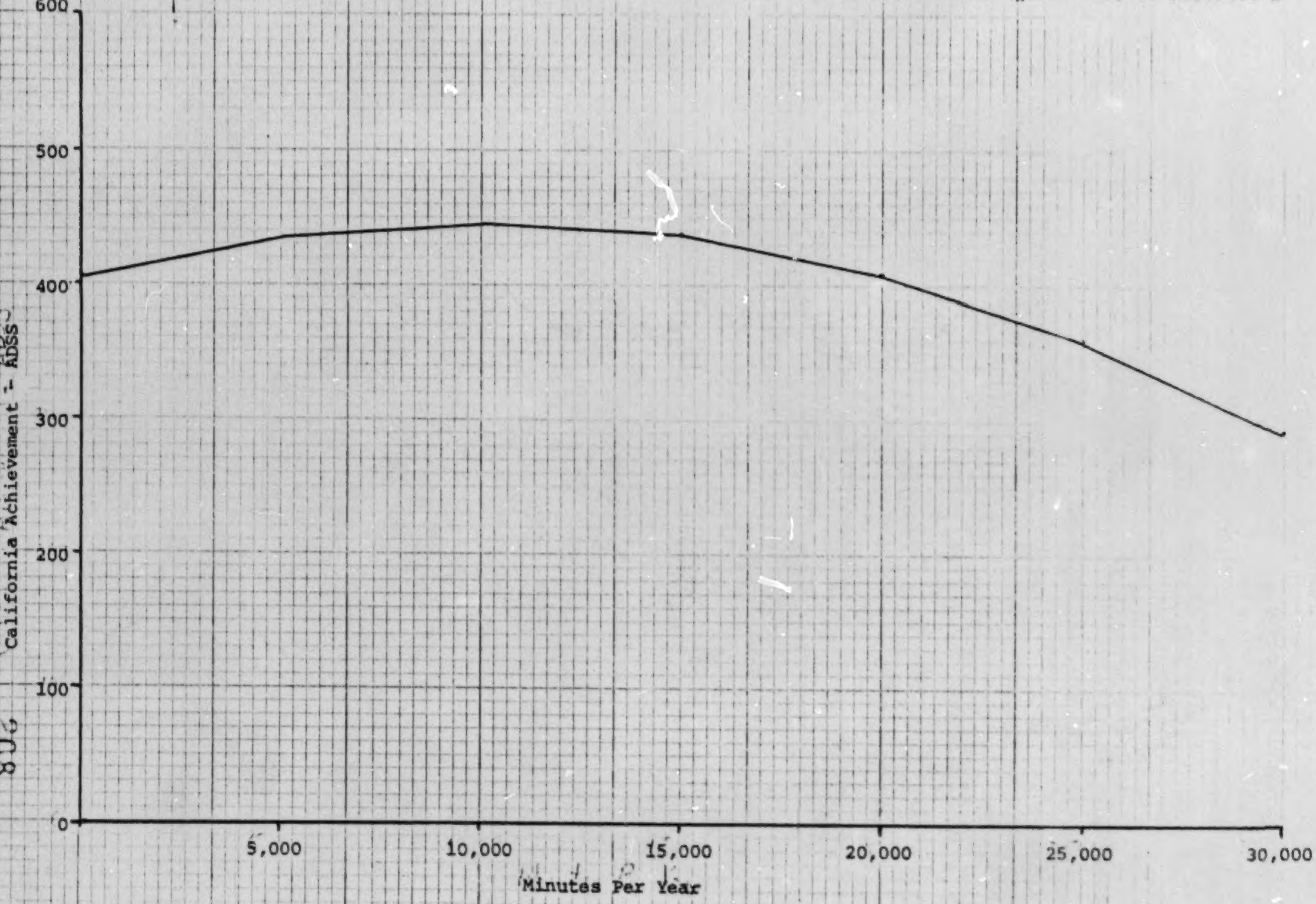


Table 9.8 Regression Analysis of Reading Achievement on Total Specialist Instructional Time (Quadratic in District B

```
SAMPLE SIZE      947
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 20  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.1261
MULTIPLE CORR. COEFFICIENT    0.3551

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     618914.62863
SUM OF SQUARES OF DEVIATION FROM REGRESSION  4288808.08227

VARIANCE OF ESTIMATE    4543.22890
STD. ERROR OF ESTIMATE    67.40348

INTERCEPT (A VALUE)   451.99190


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.      SUM OF         MEAN           F
                                           SQUARES       SQUARES        VALUE
DUE TO REGRESSION.............    2    618914.62863  309457.31432     68.1140
DEVIATION ABOUT REGRESSION...   944   4288808.08227    4543.22890
                     TOTAL...   946   4907722.71093


VARIABLE      MEAN         STD.         REG.     STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION     COEFF.   OF REG.COE.   T VALUE     CORR. COE.      ADDED         CUM.
  16         7.08437     17.15692    -2.05545    0.25100     -8.18911     -0.25754    582858.31666    0.11876
  23       344.23740   1407.67373     0.03862    0.00306      2.81714      0.09131     36056.31201    0.00739
   7       440.39704     72.02685

COMP. CHECK ON FINAL COEFF.          0.00862

VARIABLES DELETED...  1  2  3  4  5  6  8  9 10 11 12 13 14 15 17 18 19 20 21 22
```

Table 9.9 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Specialist Instructional Time (Quadratic) in District B

```
SAMPLE SIZE      947
NO. OF VARIABLES 18       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7933
MULTIPLE CORR. COEFFICIENT    0.8907

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3893371.94586
SUM OF SQUARES OF DEVIATION FROM REGRESSION  1014350.76531

VARIANCE OF ESTIMATE    1091.87381
STD. ERROR OF ESTIMATE    33.04351

INTERCEPT (A VALUE)    47.85951


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.      SUM OF         MEAN          F
                                           SQUARES       SQUARES      VALUE
DUE TO REGRESSION............    17  3893371.94586  229021.87916  209.7512
DEVIATION ABOUT REGRESSION...   929  1014350.76531    1091.87381
                     TOTAL...   946  4907722.71593


VARIABLE     MEAN        STD.        REG.     STD.ERROR    COMPUTED    PARTIAL     SUM OF SQ.   PROP. VAR.
  NO.                 DEVIATION     COEFF.   OF REG.COE.   T VALUE   CORR. COE.      ADDED         CUM.
   1       22.20000     1.99524    0.72735    0.64625     1.12562    0.03689     80563.13402    0.01642
   2       26.06938    10.23760    0.88073    0.14123     6.23606    0.20045   1941546.11132    0.39561
   3       24.61457     4.63696    0.19723    0.35380     0.56223    0.01844     47869.77824    0.00975
   4        0.30634     1.07536   -0.12747    1.25835    -0.10130   -0.00332     93978.03054    0.01915
   5       11.32735     4.16044    0.11546    0.29459     0.39193    0.01292      3525.22133    0.00072
   6      430.21943    70.35534    0.78792    0.02222    35.45701    0.75833   1696917.66589    0.34576
   8        0.11088     0.31414   -4.55647    6.99268    -0.65160   -0.02137      7321.64492    0.00149
   9        0.19535     0.39608   -0.58906    5.89588    -0.09991   -0.00328      6244.37879    0.00127
  10        0.06019     0.23796    8.64711    5.54181     1.56034    0.05113       847.53401    0.00017
  11        0.17951     0.38399    7.12854    4.31950     1.65032    0.05437      1288.31327    0.00026
  12        0.17212     0.37769    4.82491    4.17574     1.15546    0.03788       232.32737    0.00005
  13        0.07161     0.25813   10.44549    5.80024     1.80087    0.05898      4707.61167    0.00096
  16        7.08437    17.15692   -0.05396    0.13295    -0.40588   -0.01332      6627.50113    0.00135
  17       39.64604    12.14516    0.07119    0.11119     0.64019    0.02100       450.31632    0.00009
  18       83.01943    18.15113    0.02583    0.12925     0.19988    0.00656         5.10869    0.00000
  26       37.22131    32.51469    0.01398    0.05884     0.23758    0.00779        65.68894    0.00001
  23      344.23740  1407.67073   -0.00160    0.00153    -1.04028   -0.03411      1181.60946    0.00024
   7      440.39734    72.32685

COMP. CHECK ON FINAL COEFF.        -0.00160
```

Figure 9.4 Regression of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District B

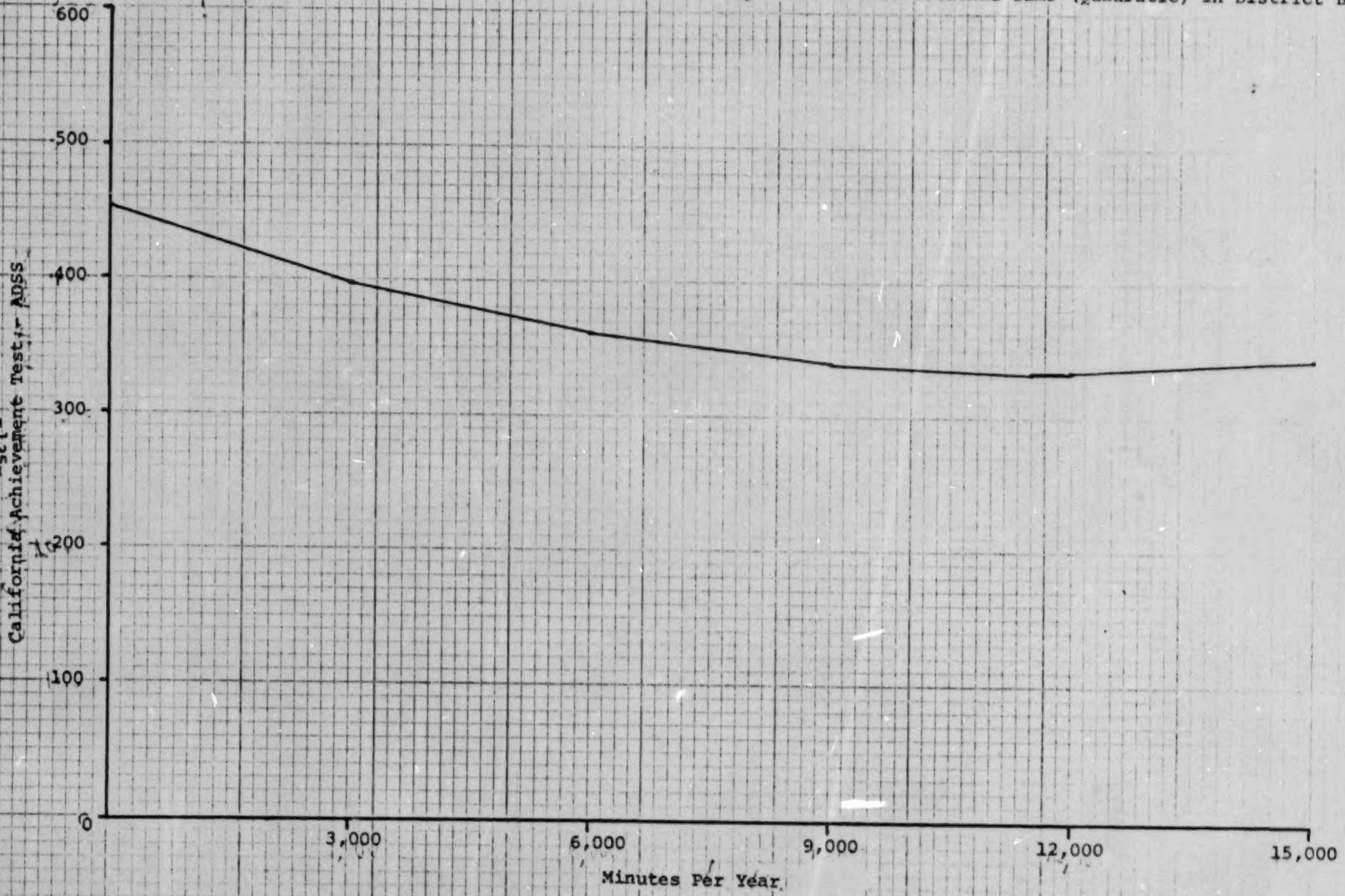


Table 9.10 Regression Analysis of Reading Achievement on Total Individualized Instruction Time (Quadratic) in District B

```
SAMPLE SIZE      947
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 20  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.0872
MULTIPLE CORR. COEFFICIENT     0.2953

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      428026.56635
SUM OF SQUARES OF DEVIATION FROM REGRESSION  4479696.14453

VARIANCE OF ESTIMATE     4745.44083
STD. ERROR OF ESTIMATE     68.88710

INTERCEPT (A VALUE)    450.86437


                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                             LINEAR  REGRESSION
         SOURCE OF VARIATION          D.F.      SUM OF          MEAN        F
                                                SQUARES        SQUARES     VALUE
DUE TO REGRESSION.............   2   428026.56635  214013.28317   45.0987
DEVIATION ABOUT REGRESSION...  944  4479696.14453    4745.44083
                     TOTAL...  946  4907722.71093


VARIABLE      MEAN        STD.         REG.      STD.ERROR      COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.     T VALUE     CORR. COE.      ADDED        CUM.
  14        9.56146     23.07555    -1.57211      0.21975      -7.15415     -0.22678    364473.40959    0.07427
  21      623.34025   2534.29012     0.00732      0.00230       3.65957      0.11827     63553.15671    0.01295
   7      440.39704     72.02685

COMP. CHECK ON FINAL COEFF.            0.00732

VARIABLES DELETED...  1  2  3  4  5  6  8  9 10 11 12 13 15 16 17 18 19 20 22 23
```

Table 9.11 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Individualized Instruction Time (Quadratic) in District B

```
SAMPLE SIZE      947
NO. OF VARIABLES 18       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.7920
MULTIPLE CORR. COEFFICIENT    0.8900

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     3887052.43481
SUM OF SQUARES OF DEVIATION FROM REGRESSION   1020670.27612

VARIANCE OF ESTIMATE    1098.67629
STD. ERROR OF ESTIMATE    33.14629

INTERCEPT (A VALUE)    48.27331


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
      SOURCE OF VARIATION          D.F.      SUM OF         MEAN          F
                                             SQUARES        SQUARES      VALUE
DUE TO REGRESSION.............     17   3887052.43481  228650.14322   208.1142
DEVIATION ABOUT REGRESSION...     929   1020670.27612    1098.67629
                     TOTAL...     946   4907722.71093


VARIABLE     MEAN        STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                  DEVIATION     COEFF.   OF REG.COE.    T VALUE   CORR. COE.      ADDED         CUM.
   1       22.20000     1.99524     0.73714    0.64830      1.13765     0.03728     80563.19402   0.01642
   2       28.06938    13.23763     0.88419    0.14161      6.24348     0.20067   1941546.11132   0.39561
   3       24.61457     4.63696     0.10136    0.35524      0.53868     0.01767     47869.77804   0.00975
   4        6.00634     1.07536    -0.19406    1.20017     -0.15326    -0.00503     93978.03054   0.01915
   5       11.32735     4.16044     0.16428    0.29504      0.55679     0.01826      3525.22133   0.00072
   6      430.21943    70.35534     0.79117    0.02243     35.26511     0.75658   1696917.66589   0.34576
   8        0.11388     0.31414    -6.10353    7.26747     -0.83984    -0.02754      7321.64492   0.00149
   9        0.19535     0.39668    -1.01631    6.16924     -0.16474    -0.00543      6244.37879   0.00127
  10        0.06319     0.23796     8.72478    5.59238      1.56012     0.05112       847.53401   0.00017
  11        0.17951     0.38399     6.91116    4.34182      1.59177     0.05215      1288.31327   0.00026
  12        0.17212     0.37769     4.55434    4.19429      1.08584     0.03563       232.32737   0.00005
  13        0.07161     0.25833    10.82224    5.88090      1.84023     0.06027      4707.61167   0.00096
  14        9.56146    23.07555    -0.10422    0.11330     -0.91979    -0.03016      1378.57259   0.00028
  17       39.64604    12.14516     0.06227    0.11196      0.55619     0.01825       381.73042   0.00008
  18       83.01943    18.15113     0.00966    0.13757      0.07026     0.00231         0.04216   0.00000
  20       37.22101    32.51469     0.00362    0.05915      0.06118     0.00201         4.37132   0.00000
  21      623.34025  2534.29012     0.00048    0.00101      0.47318     0.01552       245.98856   0.00005
   7      440.39704    72.02685

COMP. CHECK ON FINAL COEFF.        0.00048

VARIABLES DELETED...  15 16 19 22 23
```

Figure 9.5 Regression of Reading Achievement on Total Individualized Instruction Time (Quadratic) in District B

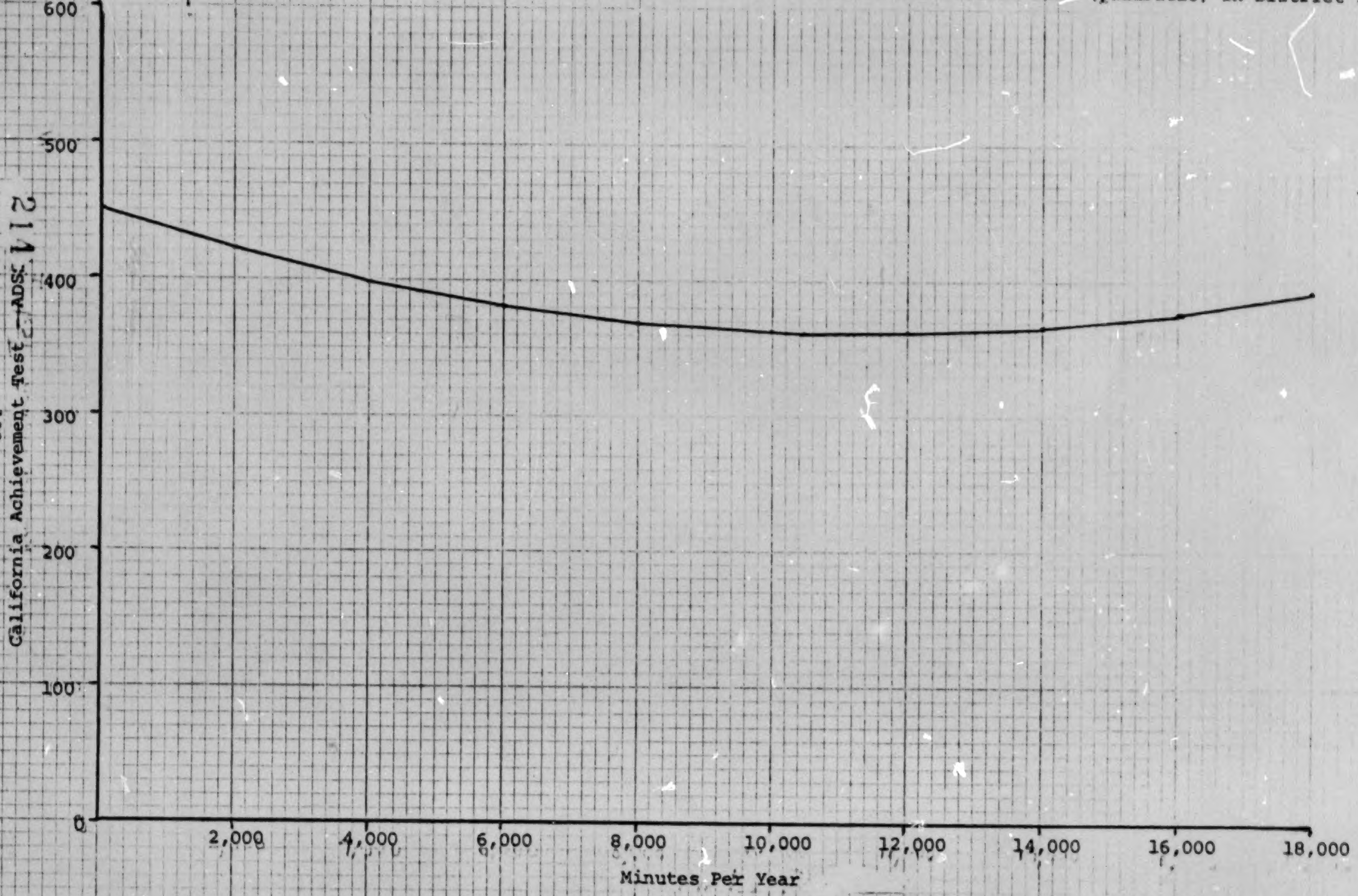


Table 9.12 Regression Analysis of Reading Achievement on Total Teacher Instructional Time (Quadratic) in District C

```
SAMPLE SIZE     967
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 17  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  6

COEFFICIENT OF DETERMINATION  0.0515
MULTIPLE CORR. COEFFICIENT    0.2270

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      275961.25879
SUM OF SQUARES OF DEVIATION FROM REGRESSION  5081572.41308

VARIANCE OF ESTIMATE    5271.34068
STD. ERROR OF ESTIMATE    72.60400

INTERCEPT (A VALUE)   334.18539


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION       D.F.      SUM OF         MEAN           F
                                          SQUARES        SQUARES        VALUE
DUE TO REGRESSION.............    2   275961.25879  137980.62939    26.1756
DEVIATION ABOUT REGRESSION...   964  5081572.41308    5271.34068
                     TOTAL...   966  5357533.67187


VARIABLE      MEAN          STD.         REG.      STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                     DEVIATION      COEFF.    OF REG.COE.   T VALUE      CORR. COE.      ADDED          CUM.
  12       116.41539     50.32660      1.04463     0.17654       5.91722      0.18721     163727.20676    0.03056
  19     16082.69370  11511.27392     -0.00356     0.00077      -4.61426     -0.14700     112234.05194    0.02095
   6       398.51955     74.47215

COMP. CHECK ON FINAL COEFF.        -0.00356

VARIABLES DELETED...  1  2  3  4  5  7  8  9 10 11 13 14 15 16 17 18 20
```

Table 9.13 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Teacher Instructional Time (Quadratic) in District C

```
SAMPLE SIZE     967
NO. OF VARIABLES 15       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  6

COEFFICIENT OF DETERMINATION  0.7501
MULTIPLE CORR. COEFFICIENT    0.8661

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     4018520.44531
SUM OF SQUARES OF DEVIATION FROM REGRESSION   1339013.22656

VARIANCE OF ESTIMATE     1406.52650
STD. ERROR OF ESTIMATE     37.50369

INTERCEPT (A VALUE)     27.79701


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
     SOURCE OF VARIATION      D.F.       SUM OF          MEAN           F
                                         SQUARES         SQUARES        VALUE
DUE TO REGRESSION............   14  4018520.44531  287037.17466   204.0752
DEVIATION ABOUT REGRESSION...  952  1339013.22656    1406.52650
                     TOTAL...  966  5357533.67187


VARIABLE      MEAN         STD.         REG.      STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                   DEVIATION      COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED         CUM.
   1       21.80807      2.20894      1.10483     0.57494      1.92163      0.06216     102773.72537     0.01918
   2       22.78883      4.59901      0.21491     0.55837      0.38489      0.01247    1166551.32156     0.21774
   3        5.90290      0.97668      0.15681     1.40079      0.11194      0.00363      97526.06653     0.01820
   4       11.81696      4.34327     -0.10799     0.41621     -0.25947     -0.00841      10287.49998     0.00192
   5      372.76143     68.31605      0.75987     0.02267     33.52412      0.73580    2511944.72698     0.46886
   7        0.21406      0.41338     33.12997     8.16787      4.05613      0.13034      24425.07623     0.00456
   8        0.22854      0.42011     12.44365     7.32669      1.69940      0.05496      20633.16643     0.00385
   9        0.13133      0.33794     34.72795     6.49597      5.34608      0.17072      39634.51510     0.00740
  10        0.21717      0.41253     33.35927    10.18993      3.27375      0.10551       4663.06431     0.00087
  12      116.41539     50.32663      0.19367     0.10538      1.83789      0.05946       9794.87504     0.00183
  14       31.25946      9.50441     -0.18645     0.16770     -1.11183     -0.03601          6.30963     0.00000
  15       41.50352     29.50301      0.67886     0.15524      4.37300      0.14033      28724.13662     0.00536
  17       58.64043     34.55560     -0.00057     0.04368     -0.01298     -0.00042         38.15638     0.00001
  19    16082.69070  11511.27392     -0.00048     0.00047     -1.03853     -0.03364       1517.01239     0.00028
   6      398.51955     74.47215

COMP. CHECK ON FINAL COEFF.          -0.00048

VARIABLES DELETED... 11 13 16 18 20
```

Figure 9.6 Regression of Reading Achievement on Total Teacher Instructional Time (Quadratic) in District C

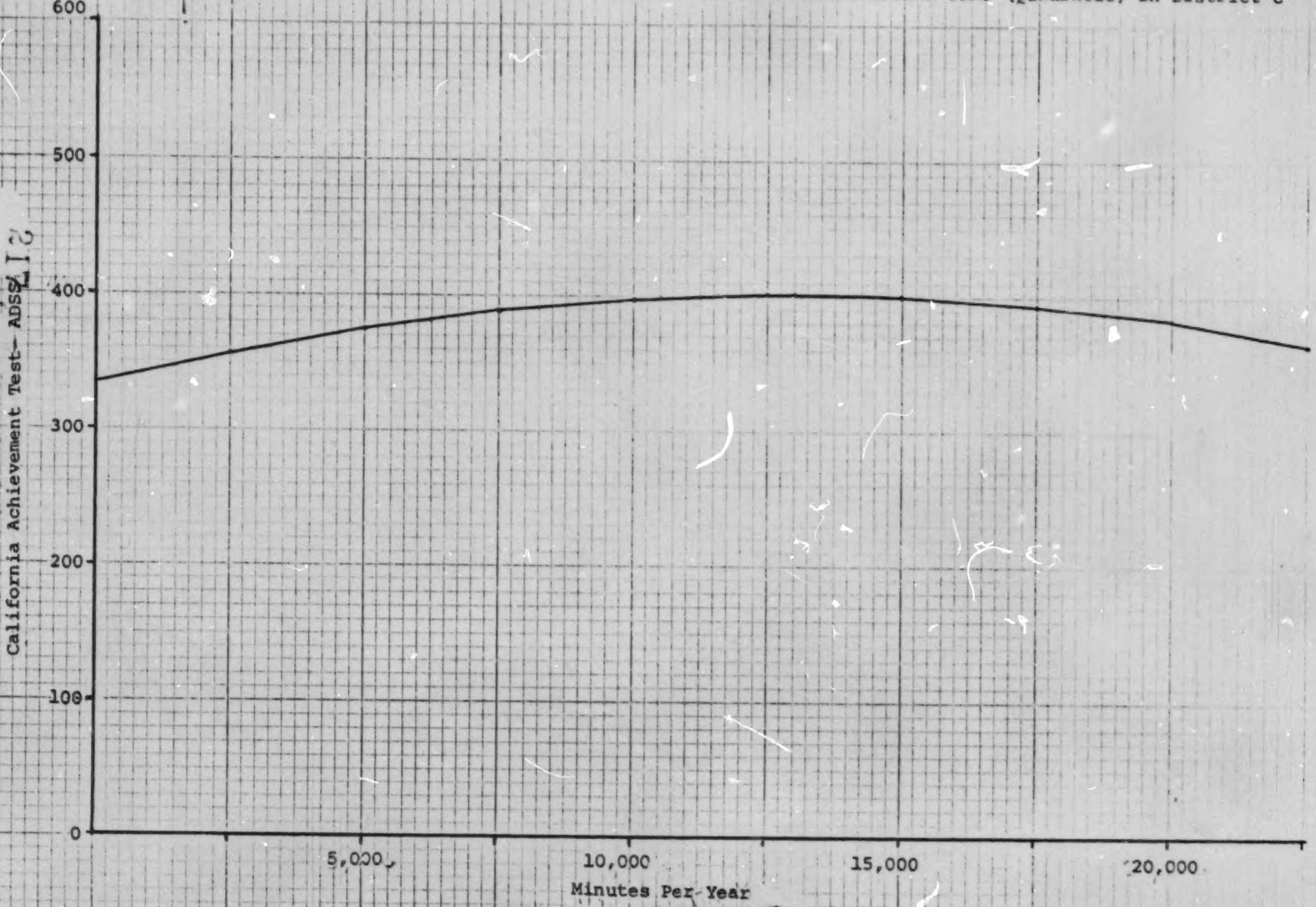


Table 9.14 Regression Analysis of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District C

```
SAMPLE SIZE      967
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 17  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  6

COEFFICIENT OF DETERMINATION  0.0576
MULTIPLE CORR. COEFFICIENT    0.2399

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      308446.45249
SUM OF SQUARES OF DEVIATION FROM REGRESSION  5049087.21936

VARIANCE OF ESTIMATE     5237.64234
STD. ERROR OF ESTIMATE     72.37156

INTERCEPT (A VALUE)    404.31763


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
     SOURCE OF VARIATION       D.F.      SUM OF         MEAN          F
                                         SQUARES       SQUARES      VALUE
DUE TO REGRESSION.............   2   308446.45249  154223.22624   29.4452
DEVIATION ABOUT REGRESSION...  964  5049087.21936    5237.64234
                    TOTAL...  966  5357533.67187


VARIABLE     MEAN        STD.        REG.      STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                 DEVIATION     COEFF.    OF REG.COE.    T VALUE     CORR. COE.     ADDED         CUM.
  13       5.96106    22.24147    -1.47306     0.20141    -7.31373     -0.22928    175392.08836    0.03274
  20     529.70545  4009.43843     0.00563     0.00112     5.04019      0.16024    133054.36413    0.02484
   6     398.51955    74.47215

COMP. CHECK ON FINAL COEFF.        0.00563

VARIABLES DELETED...  1  2  3  4  5  7  8  9 10 11 12 14 15 16 17 18 19
```

Table 9.15 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Specialist Instructional Time (Quadratic) in District C

```
SAMPLE SIZE      967
NO. OF VARIABLES 15        NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  6

COEFFICIENT OF DETERMINATION   0.7490
MULTIPLE CORR. COEFFICIENT     0.8655

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     4012819.18481
SUM OF SQUARES OF DEVIATION FROM REGRESSION   1344714.48706

VARIANCE OF ESTIMATE      1412.51522
STD. ERROR OF ESTIMATE      37.58344

INTERCEPT (A VALUE)      53.54485


                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                            LINEAR  REGRESSION
         SOURCE OF VARIATION       D.F.      SUM OF          MEAN           F
                                             SQUARES         SQUARES        VALUE
DUE TO REGRESSION.............      14    4012819.18481   286629.94178   202.9217
DEVIATION ABOUT REGRESSION....     952    1344714.48706     1412.51522
                      TOTAL...     966    5357533.67187


VARIABLE     MEAN         STD.         REG.       STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                   DEVIATION     COEFF.     OF REG.COE.    T VALUE      CORR. COE.       ADDED          CUM.
   1       21.80807      2.20894      1.18833      0.57522      2.06533       0.06679     102773.72537     0.01918
   2       22.78883      4.59901      0.58466      0.55563      1.05225       0.03408    1166551.32156     0.21774
   3        5.90290      0.97668     -1.46247      1.36347     -1.07260      -0.03474      97526.88053     0.01820
   4       11.81696      4.34327      0.19256      0.41295      0.46631       0.01511      10287.49998     0.00192
   5      372.76143     68.31605      0.76152      0.02278     33.43642       0.73491    2511944.72698     0.46886
   7        0.21406      0.41038     26.09380      7.85971      3.31994       0.10698      24425.37620     0.00456
   8        0.22854      0.42011      8.11259      7.10440      1.14191       0.03698      20633.16643     0.00385
   9        0.13133      0.33794     30.08088      6.13670      4.90180       0.15690      39634.51516     0.00740
  10        0.21717      0.41253     19.92132      9.75343      2.04249       0.06605       4663.06431     0.00087
  13        5.96136     22.24147     -0.31457      0.11653     -2.69943      -0.08716       4309.93851     0.00080
  14       31.25946      9.50441     -0.19124      0.16708     -1.14462      -0.03707        111.10929     0.00002
  15       41.50352     29.50301      0.51370      0.15484      3.31757       0.10691      21872.76682     0.00408
  17       58.64043     34.55560     -0.02921      0.04341     -0.67301      -0.02181        303.47388     0.00006
  20      529.70545   4009.43843      0.00144      0.00061      2.34719       0.07585       7781.94036     0.00145
   6      398.51955     74.47215

COMP. CHECK ON FINAL COEFF.          0.00144

VARIABLES DELETED... 11 12 16 18 19
```

Figure 9.7 Regression of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District C

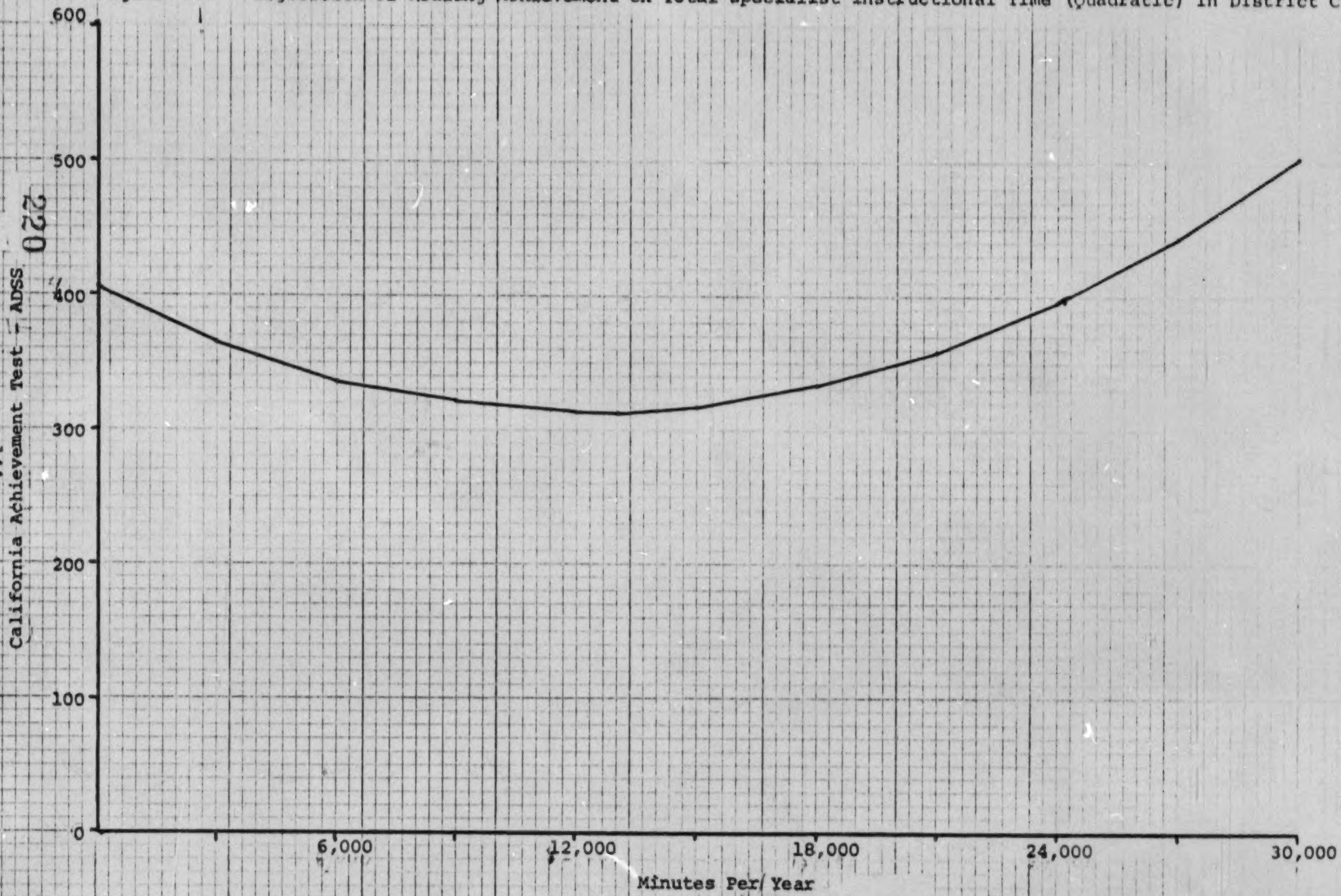


Table 9.16 Regression Analysis of Reading Achievement on Total Individualized Instruction Time (Quadratic) in District C

```
SAMPLE SIZE      967
NO. OF VARIABLES  3       NO. OF VARIABLES DELETED 17  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  6

COEFFICIENT OF DETERMINATION  0.0434
MULTIPLE CORR. COEFFICIENT    0.2082

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      232267.09539
SUM OF SQUARES OF DEVIATION FROM REGRESSION   5125266.57653

VARIANCE OF ESTIMATE     5316.66657
STD. ERROR OF ESTIMATE     72.91540

INTERCEPT (A VALUE)    404.93331


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
        SOURCE OF VARIATION      D.F.      SUM OF        MEAN          F
                                           SQUARES       SQUARES       VALUE
DUE TO REGRESSION............    2    232267.09539  116133.54770    21.8433
DEVIATION ABOUT REGRESSION...  964   5125266.57653    5316.66657
                     TOTAL...  966   5357533.67187


VARIABLE      MEAN          STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                    DEVIATION     COEFF.   OF REG.COE.   T VALUE    CORR. COE.      ADDED          CUM.
  11       14.36773      40.48266    -0.92968     0.14992    -6.20116     -0.19586   107980.09877     0.02015
  18     1843.58260    7791.07853     0.00377     0.00078     4.83496      0.15387   124286.99658     0.02320
  C       398.51955      7 .47215

COMP. CHECK ON FINAL COEFF.       0.00377

VARIABLES DELETED...  1  2  3  4  5  7  8  9 10 12 13 14 15 16 17 19 20
```

Table 9.17 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Individualized Instruction Time (Quadratic) in District C

```
SAMPLE SIZE      967
NO. OF VARIABLES 15        NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  6

COEFFICIENT OF DETERMINATION  0.7488
MULTIPLE CORR. COEFFICIENT     0.8653

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      4011765.98352
SUM OF SQUARES OF DEVIATION FROM REGRESSION    1345767.68835

VARIANCE OF ESTIMATE      1413.62152
STD. ERROR OF ESTIMATE      37.59816

INTERCEPT (A VALUE)      46.68439


                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
        SOURCE OF VARIATION       D.F.       SUM OF          MEAN          F
                                             SQUARES        SQUARES       VALUE
DUE TO REGRESSION............  14   4011765.98352   286554.71311    202.7096
DEVIATION ABOUT REGRESSION...  952  1345767.68835     1413.62152
                    TOTAL...   966  5357533.67187


VARIABLE     MEAN          STD.          REG.       STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                    DEVIATION      COEFF.     OF REG.COE.    T VALUE     CORR. COE.       ADDED          CUM.
   1       21.80837       2.20894      1.11962      0.58200      1.92373      0.06223     102773.72537     0.01918
   2       22.78883       4.59901      0.55392      0.55579      0.99664      0.03228    1166551.32156     0.21774
   3        5.90290       2.97668     -1.41153      1.36275     -1.03580     -0.03355      97526.86053     0.01820
   4       11.81696       4.34327      0.42675      0.43665      0.97733      0.03166      10287.49998     0.00192
   5      372.76143      68.31605      0.76821      0.02243     34.24551      0.74293    2511944.72698     0.46886
   7        0.21436       0.41038     29.92955      7.80649      3.83393      0.12331      24425.07620     0.00456
   8        0.22854       0.42011      6.77541      7.10406      0.95374      0.03090      20633.16643     0.00385
   9        0.13133       0.33794     30.02470      6.22653      4.82206      0.15441      39634.51516     0.00740
  10        0.21717       0.41253     22.33493      9.72749      2.29606      0.07421       4663.06431     0.00087
  11       14.36773      40.48266     -0.21620      0.08476     -2.55086     -0.08239       1214.33317     0.00023
  14       31.25946       9.50441     -0.17241      0.16737     -1.03013     -0.03337        137.77817     0.00003
  15       41.50352      29.50301      0.53698      0.15416      3.48318      0.11218      23419.75445     0.00437
  17       58.64043      34.55560     -0.01221      0.04477     -0.27264     -0.00884        351.94241     0.00007
  18     1843.58260    7791.07853      0.00103      0.00043      2.40879      0.07783       8202.21824     0.00153
   6      398.51955      74.47215

COMP. CHECK ON FINAL COEFF.          0.00103

VARIABLES DELETED...  12 13 16 19 20
```

Figure 9.8 Regression of Reading Achievement on Total Individualized Instruction Time (Quadratic) in District C

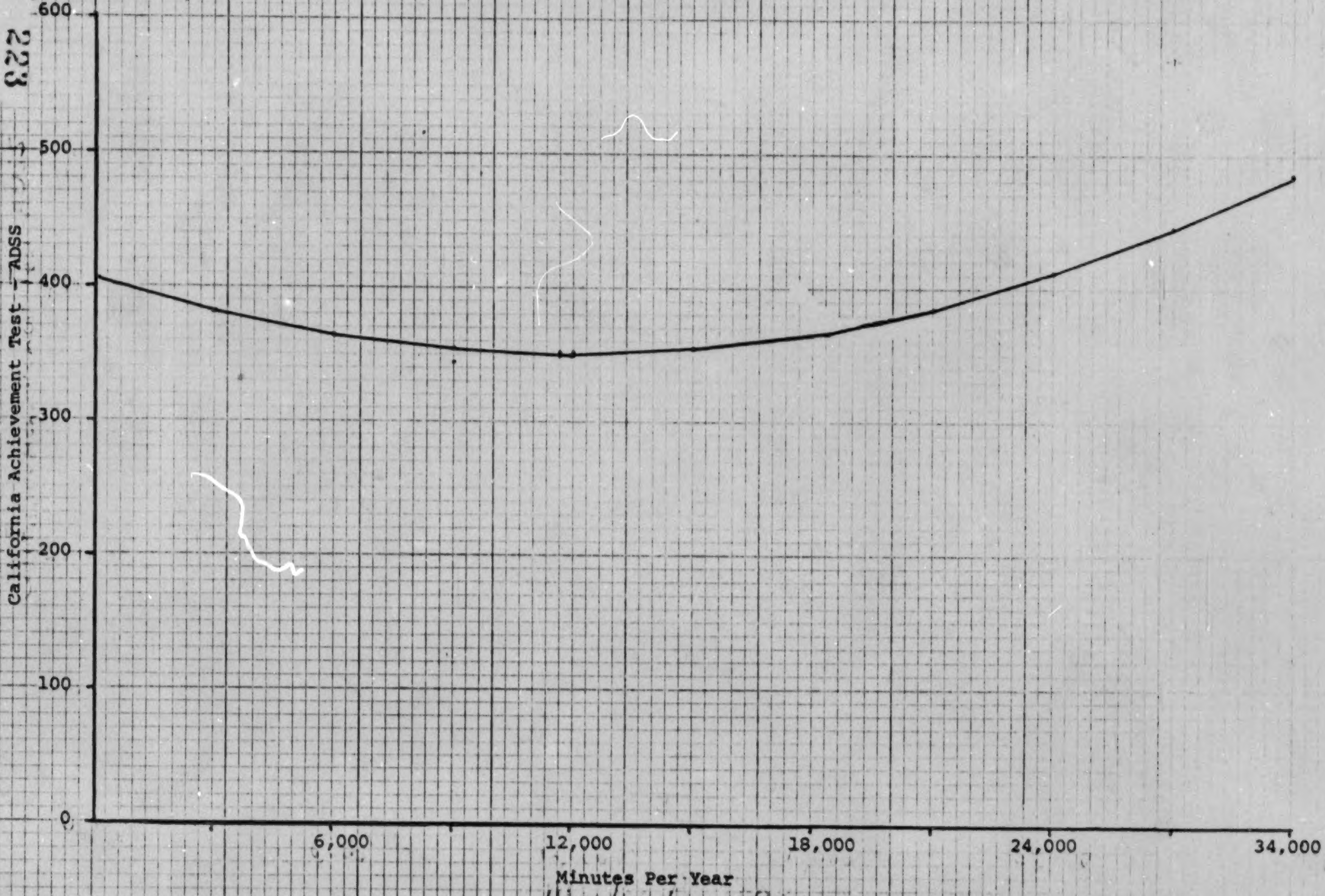


Table 9.18 Regression Analysis of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District D

```
SAMPLE SIZE      523
NO. OF VARIABLES  3       NO. OF VARIABLES DELETED 16  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE 15 NOW NO.  7

COEFFICIENT OF DETERMINATION  0.1287
MULTIPLE CORR. COEFFICIENT    0.3587

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      375857.65613
SUM OF SQUARES OF DEVIATION FROM REGRESSION  2545435.86730

VARIANCE OF ESTIMATE     4895.06898
STD. ERROR OF ESTIMATE     69.96477

INTERCEPT (A VALUE)    434.11562


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION         D.F.       SUM OF          MEAN          F
                                             SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............      2   375857.65610  187928.82805   38.3915
DEVIATION ABOUT REGRESSION...   520  2545435.86730    4895.06898
                    TOTAL...   522  2921293.52343


VARIABLE      MEAN         STD.         REG.      STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                   DEVIATION      COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED          CUM.
  12        9.43905     25.09153    -1.81412     0.31334      -5.78955     -0.24638     338285.47734     0.11580
  13      717.47667   2856.73751     0.00762     0.00275       2.77047      0.12061      37572.17873     0.01286
   7      422.46272     74.80874

COMP. CHECK ON FINAL COEFF.          0.03762

VARIABLES DELETED...  1  2  3  4  5  6  8  9 10 11 13 14 15 16 17 18
```

Table 9.19 Regression Analysis of Reading Achievement on Full Explanatory Model Variables including Total Specialist Instructional Time (Quadratic) in District D

```
SAMPLE SIZE      523
NO. OF VARIABLES 14       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.8036
MULTIPLE CORR. COEFFICIENT    0.8964

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2347586.20892
SUM OF SQUARES OF DEVIATION FROM REGRESSION    573707.31451

VARIANCE OF ESTIMATE    1127.12635
STD. ERROR OF ESTIMATE    33.57270

INTERCEPT (A VALUE)     47.97167


                    ANALYSIS OF VARIANCE FOR THE MULTIPLE
                            LINEAR  REGRESSION
        SOURCE OF VARIATION         D.F.      SUM OF         MEAN           F
                                              SQUARES        SQUARES        VALUE
DUE TO REGRESSION.............      13   2347586.20892   180583.55453   160.2159
DEVIATION ABOUT REGRESSION...      509    573707.31451     1127.12635
                       TOTAL...    522   2921293.52343


VARIABLE     MEAN        STD.        REG.        STD.ERROR     COMPUTED    PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                  DEVIATION     COEFF.      OF REG.COE.   T VALUE     CORR. COE.     ADDED         CUM.
   1       21.57208     1.92561     1.21572      1.06651      1.13991     0.05046    113097.17312    0.03871
   2       33.68413    10.13740     0.68362      0.18060      3.78533     0.16547    904053.39859    0.30947
   3       25.15296     4.32044     1.23284      0.52624      2.34274     0.10328     13493.98150    0.00462
   4        5.53155     0.74949     1.24834      2.53551      0.49234     0.02182       659.23634    0.00023
   5       10.91969     3.30929     0.37727      0.65731      0.57422     0.02544     15057.72915    0.00515
   6      409.37323    77.75206     0.69297      0.03002     23.07326     0.71500   1257217.85418    0.43036
   8        0.46845     0.49948   -23.59381     10.58479     -2.22903    -0.09832     21825.93254    0.00747
   9        0.19312     0.39512    -4.30423      6.41984     -0.67046    -0.02973       260.46291    0.00013
  12        9.44905    25.09153    -0.40551      0.15953     -2.54196    -0.11196     15625.83877    0.00535
  13       37.19137     9.79111     0.43698      0.21224      2.05888     0.09069      4382.56761    0.00150
  14       53.94532    32.74722    -0.02571      0.12974     -0.19818    -0.00878        57.52612    0.00002
  16       38.09446    30.92042     0.04273      0.10473      0.40797     0.01808       126.26251    0.00004
  19      717.47667  2856.73751     0.00169      0.00137      1.23111     0.05449      1708.30537    0.00058
   7      422.46272    74.00874

COMP. CHECK ON FINAL COEFF.         0.00169

VARIABLES DELETED... 10 11 15 17 18
```

Figure 9.9 Regression of Reading Achievement on Total Specialist Instructional Time (Quadratic) in District D

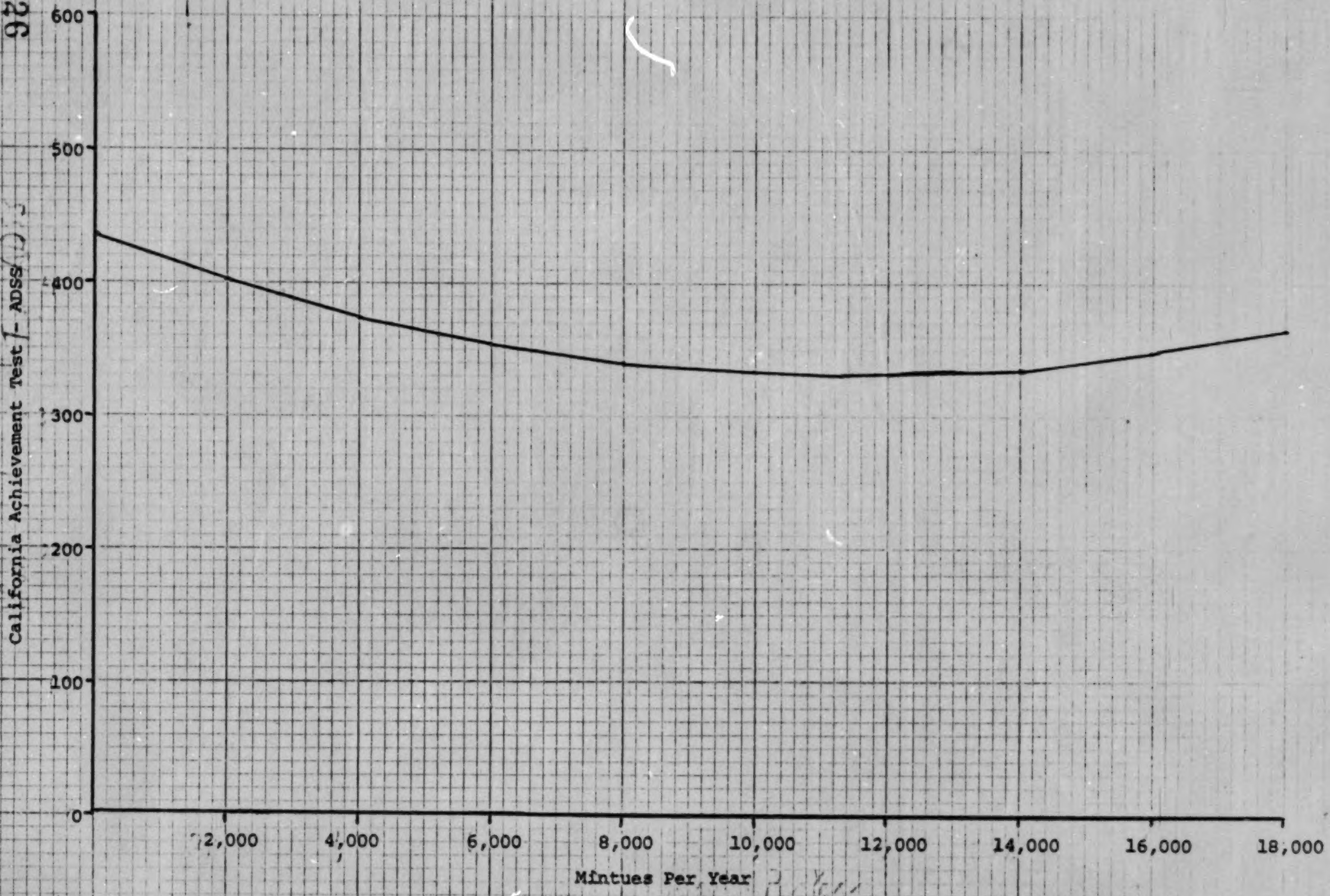


Table 9.20 Regression Analysis of Reading Achievement on Total Individualized Instruction Time (Quadratic) in District D

```
SAMPLE SIZE     523
NO. OF VARIABLES  3      NO. OF VARIABLES DELETED 16  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.0186
MULTIPLE CORR. COEFFICIENT    0.1363

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION       54305.48416
SUM OF SQUARES OF DEVIATION FROM REGRESSION   2866988.03910

VARIANCE OF ESTIMATE    5513.43854
STD. ERROR OF ESTIMATE    74.25253

INTERCEPT (A VALUE)   427.82955


                    ANALYSIS OF VARIANCE FOR THE MULTIPLE
                           LINEAR  REGRESSION
          SOURCE OF VARIATION        D.F.      SUM OF        MEAN         F
                                               SQUARES       SQUARES     VALUE
    DUE TO REGRESSION.............     2    54305.48416   27152.74208    4.9248
    DEVIATION ABOUT REGRESSION...   520  2866988.03930    5513.43854
                         TOTAL...   522  2921293.52343


VARIABLE     MEAN          STD.         REG.      STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION     COEFF.   OF REG.COE.    T VALUE    CORR. COE.       ADDED         CUM.
  10        18.81015     35.45927    -0.94586     0.31614     -2.99188     -0.13009     17360.12947    0.00594
  17      1609.77771   3757.36788     0.00772     0.00298      2.58862      0.11279     36945.35467    0.01265
   7       422.46272     74.60874

COMP. CHECK ON FINAL COEFF.          0.00772

VARIABLES DELETED...  1  2  3  4  5  6  8  9 11 12 13 14 15 16 18 19
```

Table 9.21 Regression Analysis of Reading Achievement on Full Explanatory Model Variables Including Total Individualized Instruction Time (Quadratic) in District D

```
SAMPLE SIZE      523
NO. OF VARIABLES 14         NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  7

COEFFICIENT OF DETERMINATION  0.8041
MULTIPLE CORR. COEFFICIENT    0.8967

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2348907.82318
SUM OF SQUARES OF DEVIATION FROM REGRESSION    572385.70025

VARIANCE OF ESTIMATE      1124.52986
STD. ERROR OF ESTIMATE      33.53431

INTERCEPT (A VALUE)      -5.78292


                    ANALYSIS OF VARIANCE FOR THE MULTIPLE
                              LINEAR  REGRESSION
       SOURCE OF VARIATION             D.F.        SUM OF          MEAN           F
                                                  SQUARES        SQUARES        VALUE
DUE TO REGRESSION.............   13   2348907.82318  180685.21717   160.6762
DEVIATION ABOUT REGRESSION...   509    572385.70025    1124.52986
                     TOTAL...   522   2921293.52343


VARIABLE       MEAN          STD.          REG.        STD.ERROR     COMPUTED      PARTIAL        SUM OF SQ.     PROP. VAR.
  NO.                      DEVIATION      COEFF.      OF REG.COE.    T VALUE     CORR. COE.       ADDED           CUM.
   1         21.57228       1.92561      1.81753       1.09551       1.65908      0.07334     113097.17312      0.03871
   2         30.68413      10.13740      0.68371       0.18149       3.76725      0.16470     904053.39859      0.30947
   3         25.15296       4.32644      1.61378       0.53847       2.99695      0.13168      13493.98150      0.00462
   4          5.53155       0.74949      3.13619       2.55583       1.22707      0.05431        659.23634      0.00023
   5         10.91969       3.30929      0.78418       0.67098       1.16870      0.05173      15057.72915      0.00515
   6        439.37323      77.75206      0.71209       0.02908      24.48597      0.73542    1257217.85418      0.43036
   8          0.46845       0.49949    -15.34301      10.82078      -1.41792     -0.06272      21825.93254      0.00747
   9          0.19312       0.39512      8.85414       6.85085       1.29242      0.05719        280.46291      0.00010
  10         18.81015      35.45927     -0.44135       0.15166      -2.91020     -0.12793      15700.49646      0.00537
  13         37.19197       9.79111     -0.39156       0.21332       1.78867      0.07931       2955.35907      0.00101
  14         64.94532      32.74722      0.06283       0.13385       0.46936      0.02080        349.20581      0.00012
  16         38.59446      30.92047      0.03164       0.10438       0.30309      0.01343        105.49319      0.00004
  17       1608.77771    3757.36785      0.00274       0.00143       1.91213      0.08445       4111.56092      0.00141
   7        422.46272      74.90874

COMP. CHECK ON FINAL COEFF.          0.00274


VARIABLES DELETED... 11 12 15 18 19
```

Figure 9.10 Regression of Reading Achievement on Total Individualized Instruction Time (Quadratic) in District D

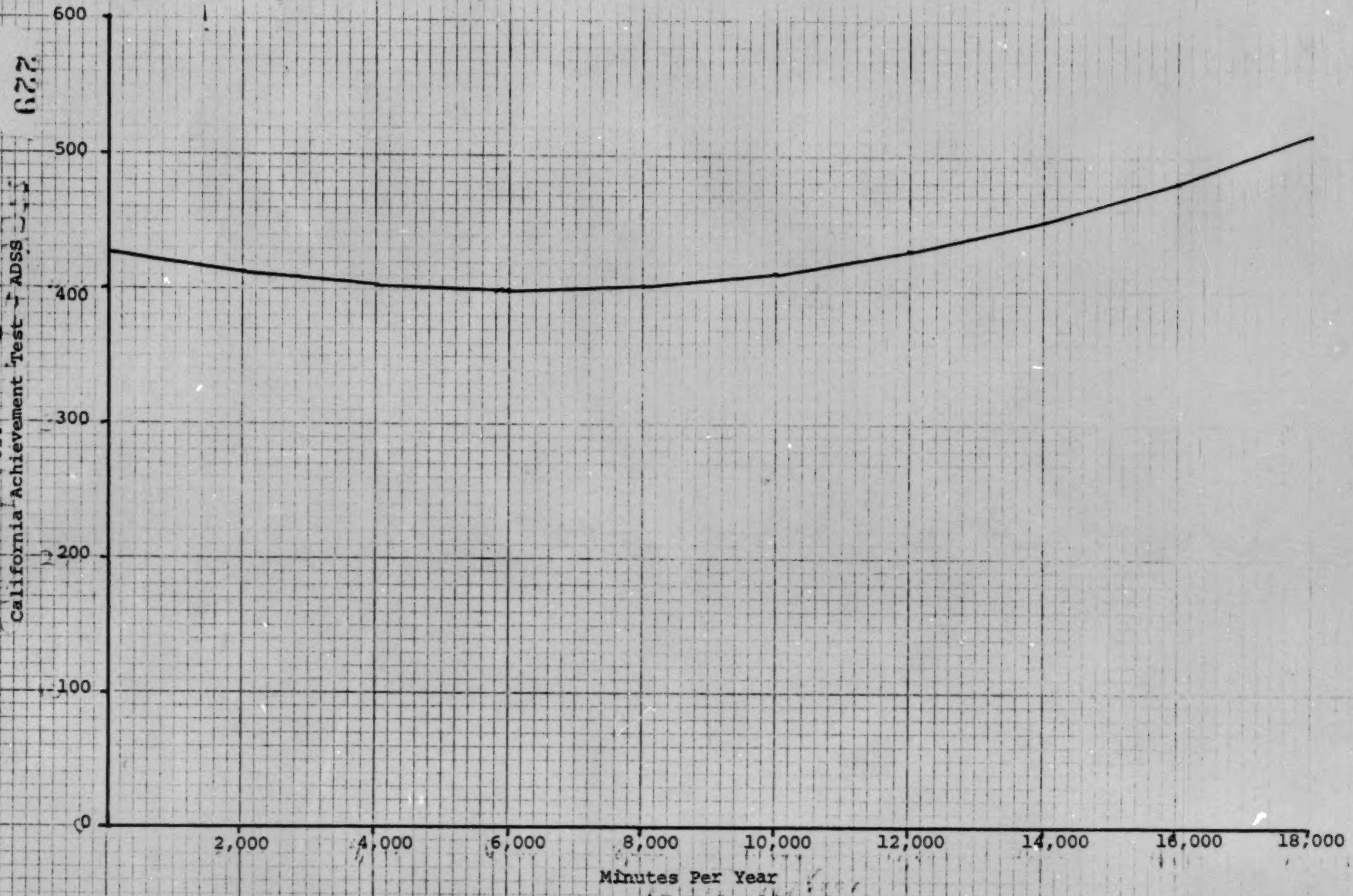


Table 9.22 Variables Used in Models 1 through 6 for Regression Analyses of Curvilinear Interaction

Variable		Model					
		1	2	3	4	5	6
1	CAT-ADSS	D	D	D	D	D	D
3	X_1 = 1 if high ability	X	X	X		X	
6	X_2 = 1 if low ability	X	X	X		X	
7	X_3 = time of high ability X .01	X	X				
8	X_4 = time of low ability X .01	X	X				
9	$X_5 = X_3^2$	X					
10	$X_6 = X_4^2$	X					
11	$Z_1 = X_3 + X_4$			X	X	X	X
12	$Z_2 = X_3^2 + X_4^2$					X	X

Note: Variables 2, 4, and 5 have been omitted since they were used only to transgenerate variables included in the model.

"D" indicates dependent variable.

"X" indicates variable included in model.

Table 9.23 Regression Analysis of Achievement on Total Teacher Instruction Time in District A - Model 3

```
SAMPLE SIZE     567
NO. OF VARIABLES  4      NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.5885
MULTIPLE CORR. COEFFICIENT    0.7672

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    1371554.53823
SUM OF SQUARES OF DEVIATION FROM REGRESSION   958900.62969

VARIANCE OF ESTIMATE     1703.19828
STD. ERROR OF ESTIMATE     41.26982

INTERCEPT (A VALUE)   439.74805


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
     SOURCE OF VARIATION       D.F.     SUM OF          MEAN         F
                                        SQUARES        SQUARES      VALUE
DUE TO REGRESSION............   3  1371554.53823  457184.84608   268.4273
DEVIATION ABOUT REGRESSION... 563   958900.62969    1703.19828
                     TOTAL... 566  2330455.16796


VARIABLE      MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION    COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED         CUM.
   3        0.32804      0.46991    89.77941     7.93094    11.32015      0.43059  1203956.87249    0.51662
   6        0.12875      0.33522   -51.45689     8.70930    -5.90827     -0.24163   167478.15672    0.07186
  11       36.36210     44.42506    -0.02302     0.08691    -0.26489     -0.01116      119.50910    0.00005
   1      461.73739     64.16706

COMF. CHECK ON FINAL COEFF.         -0.02302

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.11 Effect of Total Teacher Instruction on Achievement in District A - Model 3

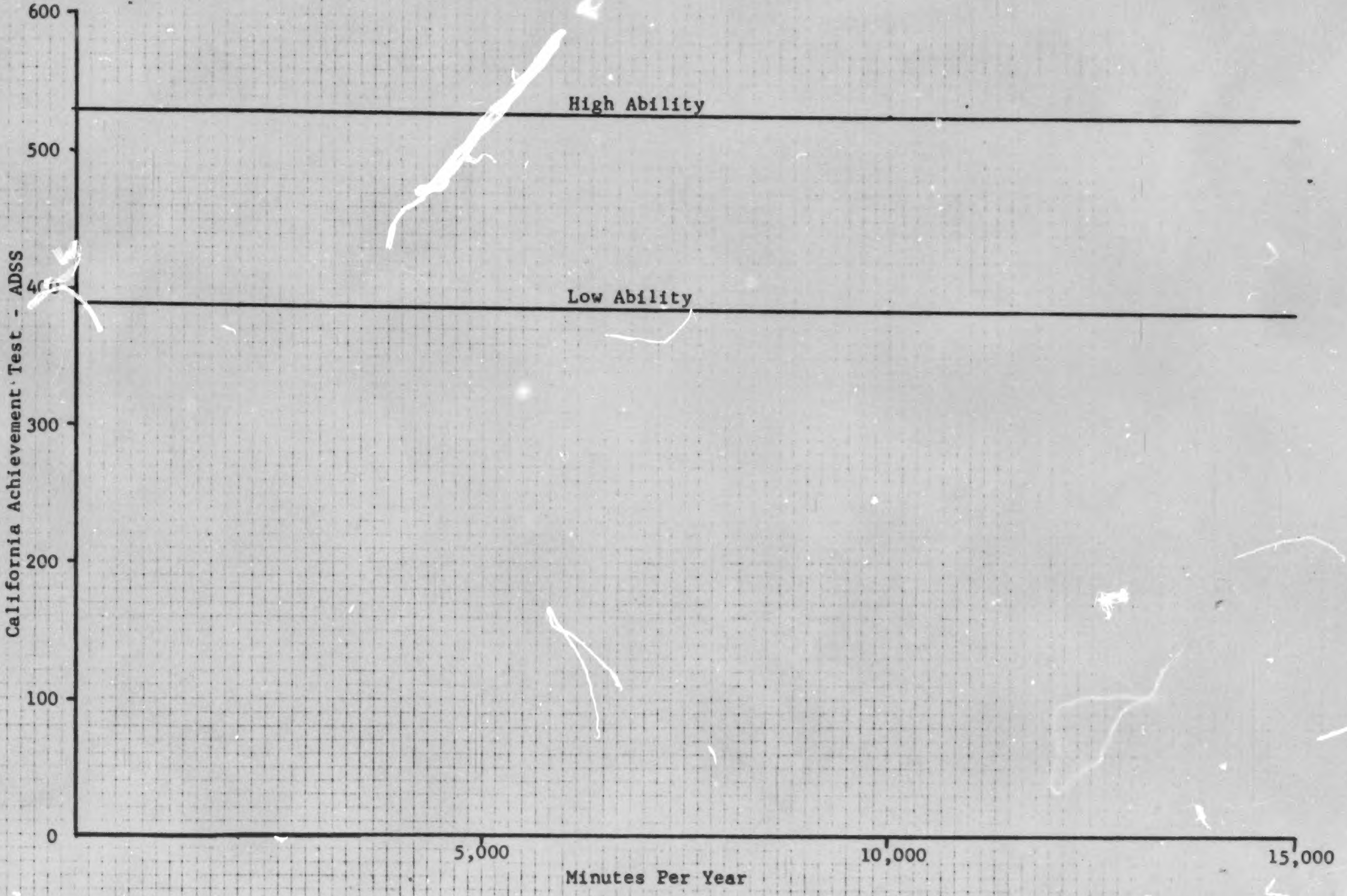


Table 9.24 Regression Analysis of Achievement on Whole Group Teacher Time in District A - Model 3

```
SAMPLE SIZE     567
NO. OF VARIABLES  4      NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.5901
MULTIPLE CORR. COEFFICIENT    0.7682

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    1375267.92715
SUM OF SQUARES OF DEVIATION FROM REGRESSION   955187.24078

VARIANCE OF ESTIMATE    1696.60256
STD. ERROR OF ESTIMATE    41.18984

INTERCEPT (A VALUE)   439.74805


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
     SOURCE OF VARIATION         D.F.      SUM OF           MEAN           F
                                           SQUARES         SQUARES        VALUE
DUE TO REGRESSION.............     3  1375267.92715  458422.64239   270.2004
DEVIATION ABOUT REGRESSION...    563   955187.24078    1696.60256
                     TOTAL...    566  2330455.16796


VARIABLE      MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL       SUM CF SQ.    PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.       ADDED         CUM.
   3        0.32804      0.46991    91.18641     4.39257     20.75922     0.65846   1203956.87249    0.51662
   6        0.12875      0.33522   -51.07159     5.55825     -9.18843    -0.36112    167478.15672    0.07186
  11        9.99697     22.29120    -0.13487     0.08973     -1.50305    -0.06322      3832.89796    0.00164
   1      461.73739     64.16706

COMP. CHECK ON FINAL COEFF.       -0.13487

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.12 Effect of Whole Group Teacher Time on Achievement in District A - Model 3

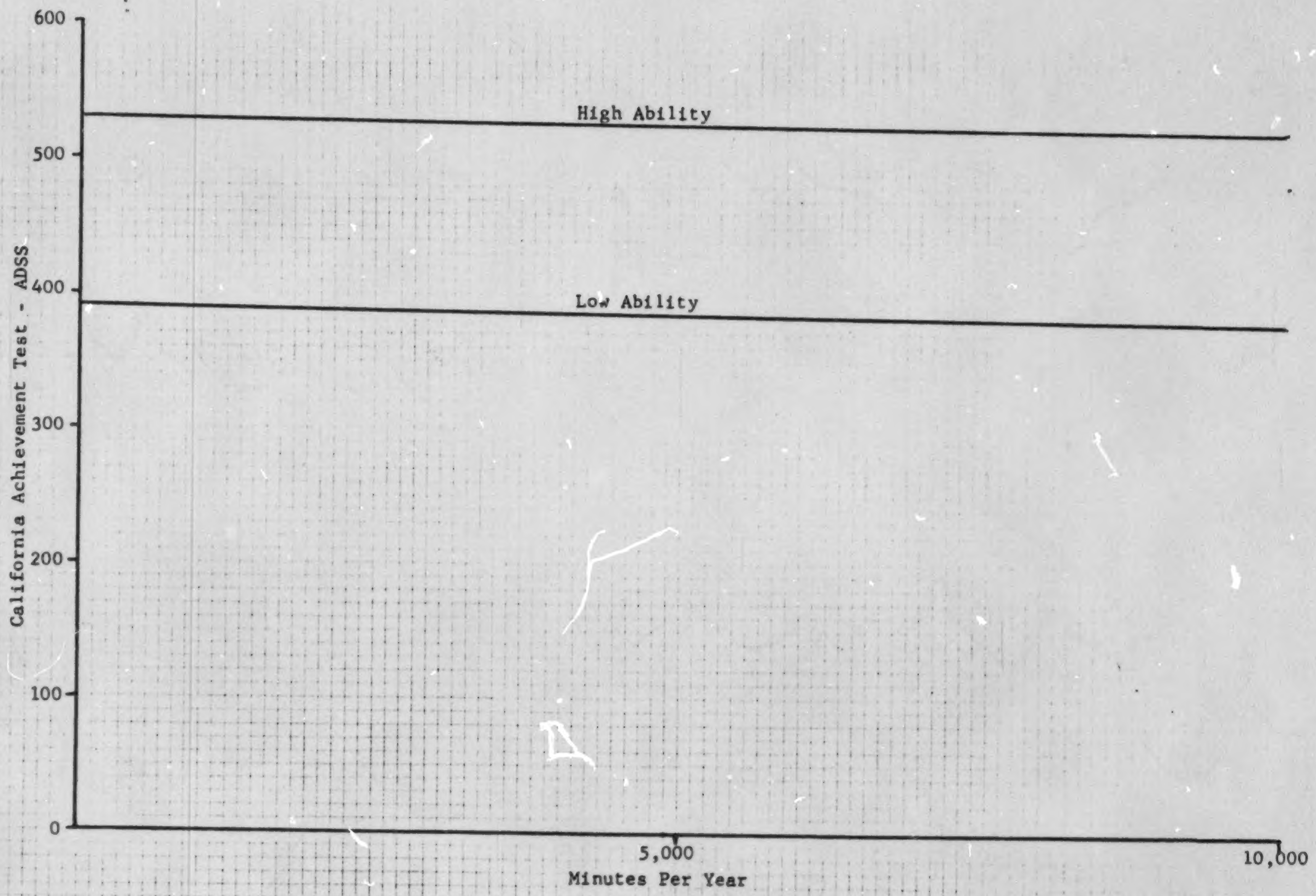


Table 9.25   Regression Analysis of Achievement on Small Group Instruction Time in District A - Model 3

```
SAMPLE SIZE     567
NO. OF VARIABLES  4      NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.5895
MULTIPLE CORR. COEFFICIENT    0.7678

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    1373755.47564
SUM OF SQUARES OF DEVIATION FROM REGRESSION   956699.69232

VARIANCE OF ESTIMATE     1699.28897
STD. ERROR OF ESTIMATE     41.22243

INTERCEPT (A VALUE)   439.74805


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                           LINEAR  REGRESSION
     SOURCE OF VARIATION          D.F.      SUM OF         MEAN          F
                                           SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............      3  1373755.47564  457918.49188   269.4765
DEVIATION ABOUT REGRESSION...     563   956699.69232    1699.28897
                     TOTAL...     566  2330455.16796


VARIABLE      MEAN        STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.  T VALUE     CORR. COE.     ADDED          CUM.
   3        0.32804     0.46991    82.57718     5.97622    13.81763     0.50323  1203956.87249    0.51662
   6        0.12875     0.33522   -59.23052     7.40195    -8.00261    -0.31956   167478.15672    0.07186
  11       26.29082    35.65680     0.09609     0.08223     1.16856     0.04919     2320.44655    0.00100
   1      461.73739    64.16706

COMP. CHECK ON FINAL COEFF.        0.09609

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.13 Effect of Small Group Instruction on Achievement in District A - Model 3

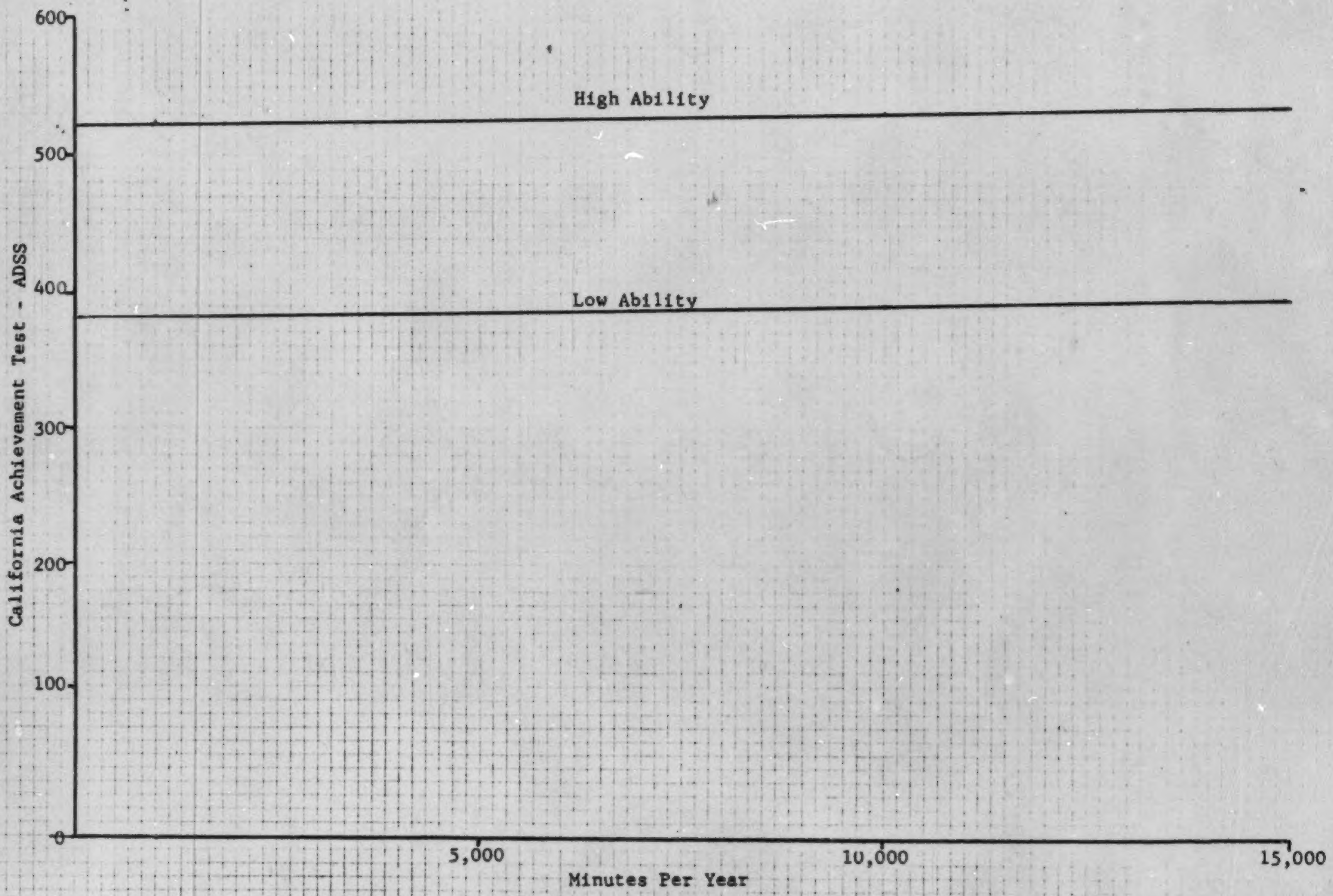


Table 9.26 Regression Analysis of Achievement on Total Specialist Time in District A - Model 3

```
SAMPLE SIZE    567
NO. OF VARIABLES  4     NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.5913
MULTIPLE CORR. COEFFICIENT    0.7690

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    1378026.84762
SUM OF SQUARES OF DEVIATION FROM REGRESSION   952428.32031

VARIANCE OF ESTIMATE     1691.70217
STD. ERROR OF ESTIMATE     41.13031

INTERCEPT (A VALUE)   439.74805


               ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.      SUM OF        MEAN          F
                                          SQUARES       SQUARES      VALUE
DUE TO REGRESSION.............    3  1378026.84762  459342.28254  271.5267
DEVIATION ABOUT REGRESSION...   563   952428.32031    1691.70217
                     TOTAL...   566  2330455.16796


VARIABLE     MEAN         STD.        REG.      STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION    COEFF.    OF REG.COE.    T VALUE    CORR. COE.       ADDED         CUM.
   3        0.32804     0.46991    88.10032     3.82025     23.06141      0.69697  1203956.87249    0.51662
   6        0.12875     0.33522   -49.77089     5.64036     -8.82407     -0.34857   167478.15672    0.07186
  11        0.49668     0.55503    -1.01353     0.51345     -1.97397     -0.08231     6551.81847    0.00283
   1      461.73739    64.16706

COMP. CHECK ON FINAL COEFF.        -1.01353

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.14 Effect of Total Specialist Time on Achievement in District A - Model 3

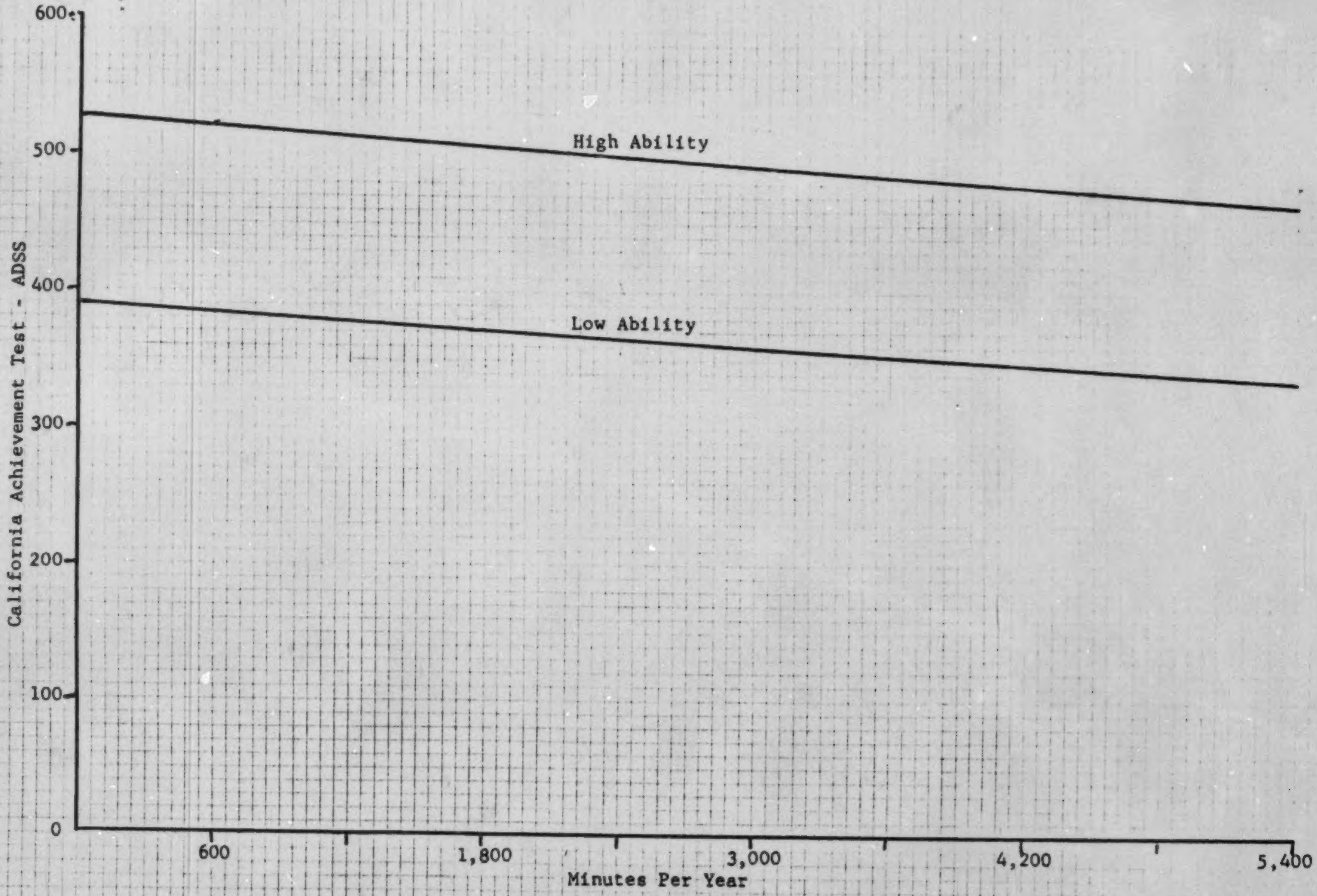


Table 9.27 Regression Analysis of Achievement on Total Individualized Instruction in District A - Model 1

```
SAMPLE SIZE      567
NO. OF VARIABLES  7       NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7256
MULTIPLE CORR. COEFFICIENT    0.8518

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     1691047.37191
SUM OF SQUARES OF DEVIATION FROM REGRESSION    639407.79602

VARIANCE OF ESTIMATE     1141.79964
STD. ERROR OF ESTIMATE     33.79053

INTERCEPT (A VALUE)    431.22345


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.       SUM OF          MEAN           F
                                            SQUARES        SQUARES       VALUE
DUE TO REGRESSION............      6  1691047.37191  281841.22866   246.8395
DEVIATION ABOUT REGRESSION...    560   639407.79602    1141.79964
                     TOTAL...    566  2330455.16796


VARIABLE      MEAN         STD.         REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.       ADDED         CUM.
   3        0.32804      0.46991  -409.07697      0.00000      0.00000     0.00000  1203956.87249     0.51662
   6        0.12875      0.33522   -52.70313  3008.29609     -0.01752    -0.00060   167478.15672     0.07186
   7        0.03280      0.04699  -382.98047***********     -0.00022    -0.00001       -0.02920    -0.00000
   8        0.08598      1.74472    -0.8750030155.33007     -0.00003    -0.00000     1275.97908     0.00055
   9        0.00328      0.0047056128.99625***********      0.00306     0.00010        0.01074     0.00000
  10        4.04607     72.50204     0.00195   724.01753      0.00000     0.00000        0.00000     0.00000
   1      461.73739     64.16706

COMP. CHECK ON FINAL COEFF.        -0.00338

VARIABLES DELETED...  2  4  5 11 12
```

Figure 9.15 Effect of Total Individualized Instruction in Achievement in District A - Model 1

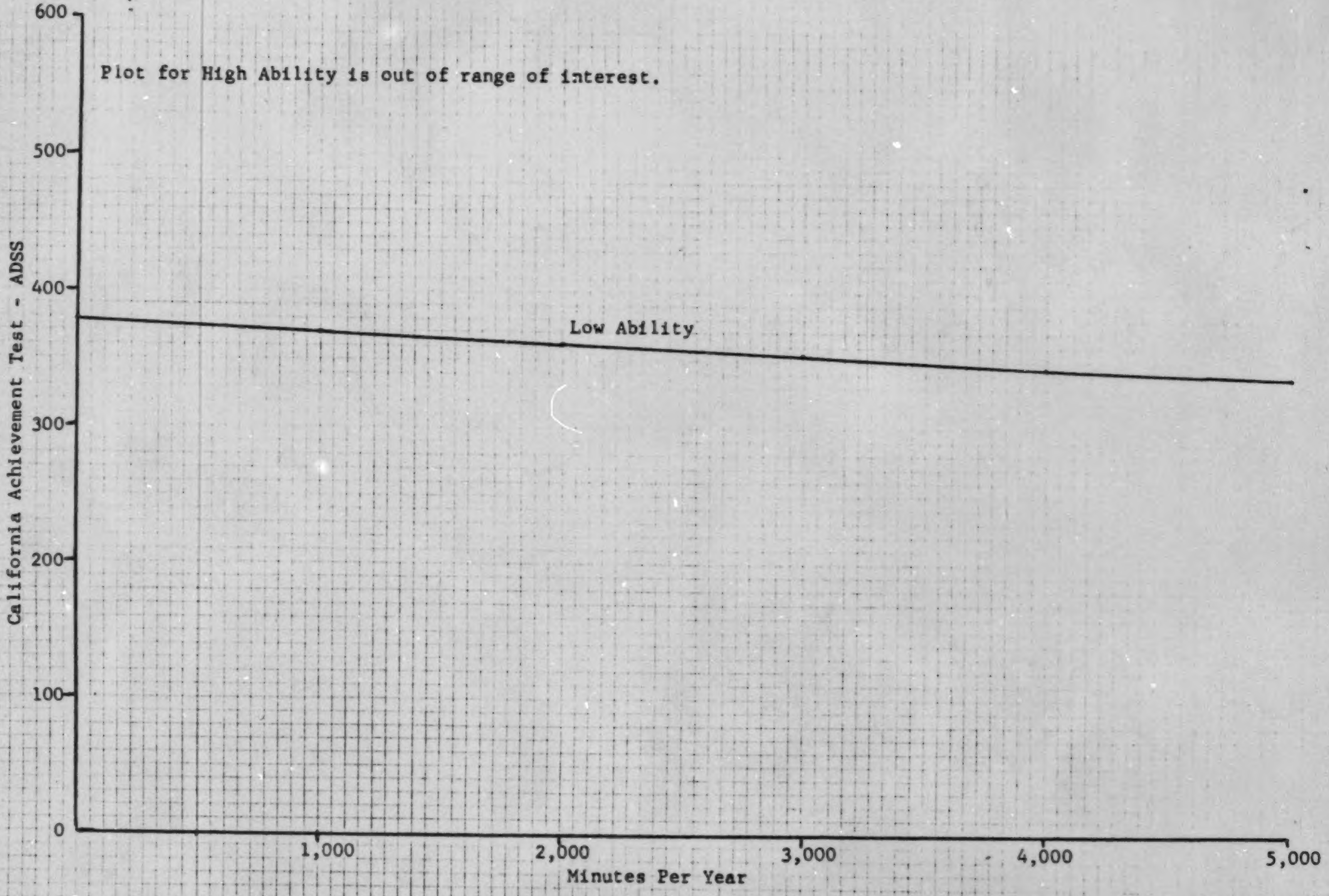

Plot for High Ability is out of range of interest.

Table 9.28 Regression Analysis of Achievement on Total Teacher Time in District B - Model 5

```
SAMPLE SIZE     947
NO. OF VARIABLES  5      NO. OF VARIABLES DELETED  7  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.6417
MULTIPLE CORR. COEFFICIENT    0.8010

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     3149167.14477
SUM OF SQUARES OF DEVIATION FROM REGRESSION   1758555.56616

VARIANCE OF ESTIMATE     1866.83181
STD. ERROR OF ESTIMATE     43.23685

INTERCEPT (A VALUE)   429.11973


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
    SOURCE OF VARIATION          D.F.      SUM OF        MEAN           F
                                           SQUARES       SQUARES        VALUE
DUE TO REGRESSION............     4   3149167.14477  787291.78619   421.7261
DEVIATION ABOUT REGRESSION...   942   1758555.56616    1866.83181
                     TOTAL...   946   4907722.71093

VARIABLE     MEAN          STD.         REG.       STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                    DEVIATION     COEFF.    OF REG.COF.    T VALUE    CORR. COE.       ADDED          CUM.
   3        0.30834       0.46205     70.24671     6.32061     11.11392     0.34048    2406074.82324     0.4902
   6        0.21542       0.41133    -85.77655     5.93237    -14.45907    -0.42618     725137.68945     0.1477
  11       40.42760      50.41434      0.33375     0.10792      3.09253     0.10025       3943.06777     0.0008
  12     4173.31255    6430.81625     -0.00129     0.00047     -2.73962    -0.08891      14011.56416     0.0028
   1      440.39764      72.22685

COMP. CHECK ON FINAL COEFF.      -0.00129

VARIABLES DELETED...  2  4  5  7  8  9 10
```

Figure 9.16 Effect of Total Teacher Time on Achievement in District B - Model 5

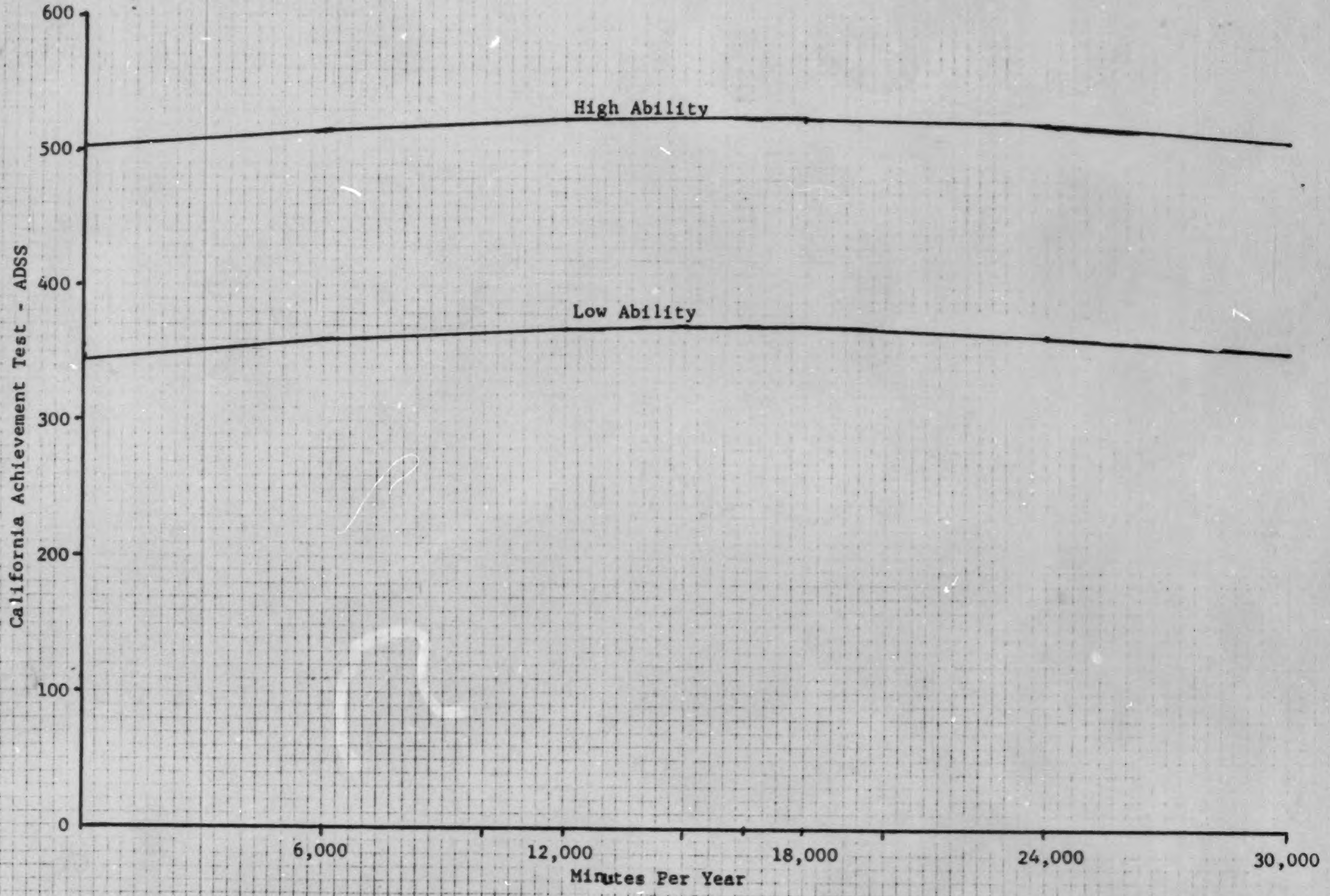


Table 9.29 Regression Analysis of Achievement on Whole Group Teacher Time In District B - Model 3

```
SAMPLE SIZE      947
NO. OF VARIABLES  4       NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.6381
MULTIPLE CORR. COEFFICIENT    0.7988

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     3131799.66699
SUM OF SQUARES OF DEVIATION FROM REGRESSION   1775923.04394

VARIANCE OF ESTIMATE     1883.26940
STD. ERROR OF ESTIMATE     43.39665

INTERCEPT (A VALUE)    429.11973


               ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
      SOURCE OF VARIATION          D.F.       SUM OF          MEAN          F
                                              SQUARES        SQUARES       VALUE
DUE TO REGRESSION...............     3  3131799.66699 1043933.22233   554.3196
DEVIATION ABOUT REGRESSION...   943  1775923.04394    1883.26943
                         TOTAL...   946  4907722.71093


VARIABLE      MEAN        STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                  DEVIATION     COEFF.    OF REG.COF.   T VALUE    CORR. COE.      ADDED          CUM.
   3        0.30834     0.46205    87.56113     3.55378     24.63886     0.62541   2406074.82324    0.49320
   6        0.21542     0.41133   -71.36235     3.76439    -18.95723    -0.52513    725137.68945    0.14775
  11       12.27848    35.39323    -0.02836     0.05379     -3.55837    -0.01819       587.15435    0.00012
   1      446.39704    72.02685

COMP. CHECK ON FINAL COEFF.       -0.02836

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.17 Effect of Whole Group Teacher Time on Achievement in District B - Model 3

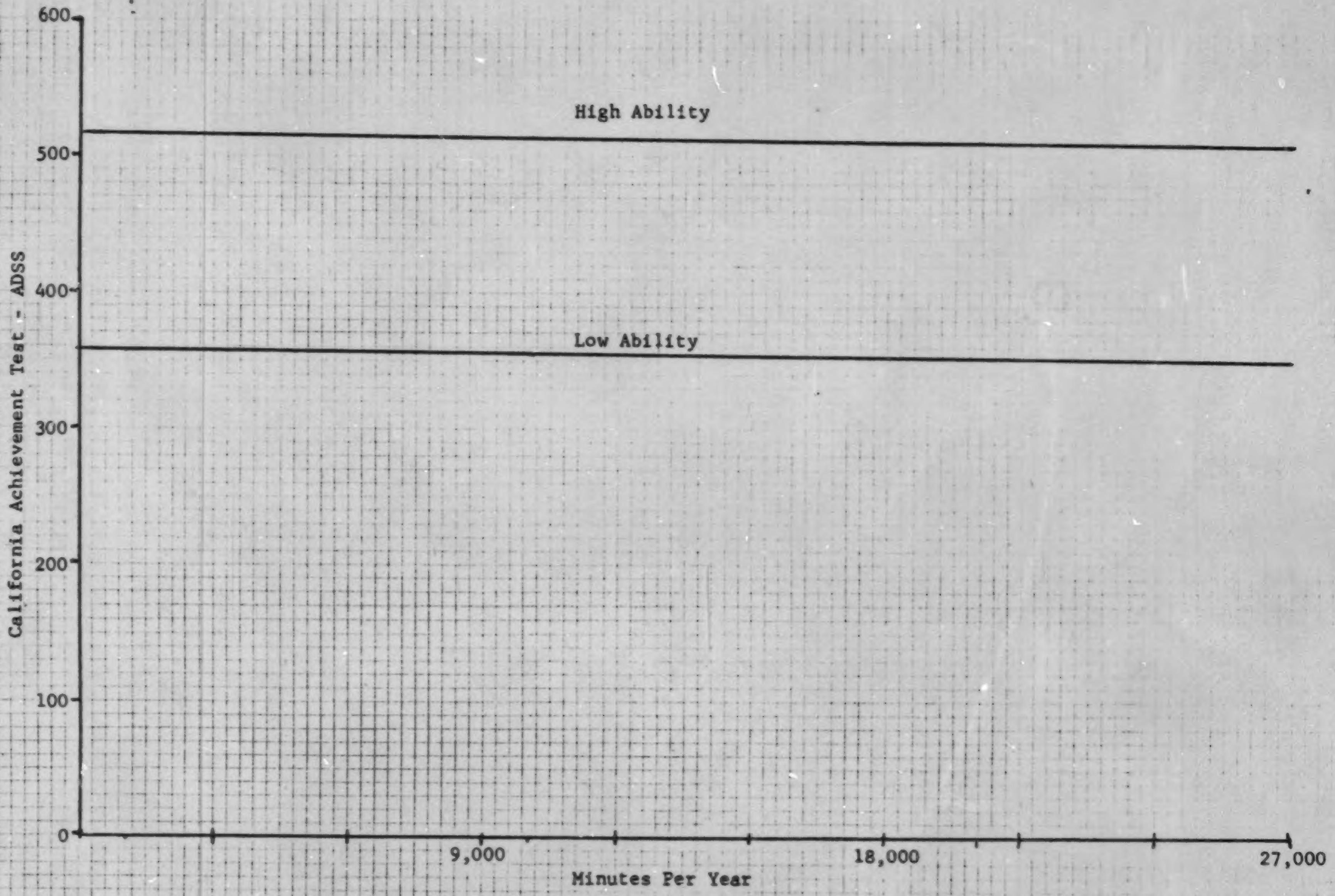


Table 9.30 Regression Analysis of Achievement on Small Group Teacher Time in District B - Model 3

```
SAMPLE SIZE      947
NO. OF VARIABLES  4         NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.6404
MULTIPLE CORR. COEFFICIENT    0.8003

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      3143139.58734
SUM OF SQUARES OF DEVIATION FROM REGRESSION    1764583.12353

VARIANCE OF ESTIMATE      1871.24403
STD. ERROR OF ESTIMATE      43.25788

INTERCEPT (A VALUE)    429.11973


                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION         D.F.        SUM OF          MEAN          F
                                              SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............     3   3143139.58734 1047713.19578   559.9020
DEVIATION ABOUT REGRESSION...    943   1764583.12353    1871.24403
                      TOTAL...   946   4907722.71093


VARIABLE    . MEAN         STD.          REG.      STD.ERROR    COMPUTED      PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION       COEFF.    OF REG.COE.   T VALUE     CORR. COE.      ADDED         CUM.
   3        0.30834      0.46225      80.76996     4.02578     20.06320      0.54696    2406074.82324    0.49026
   6        0.21542      0.41133     -78.54962     4.51260    -17.40671     -0.49313     725137.68945    0.14775
  11       26.05329     37.55928       0.12641     0.05007      2.52465      0.08194      11927.07469    0.00243
   1      440.39734     72.02685

COMP. CHECK ON FINAL COEFF.          0.12641

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.18 Effect of Small Group Teacher Time on Achievement in District B - Model 3

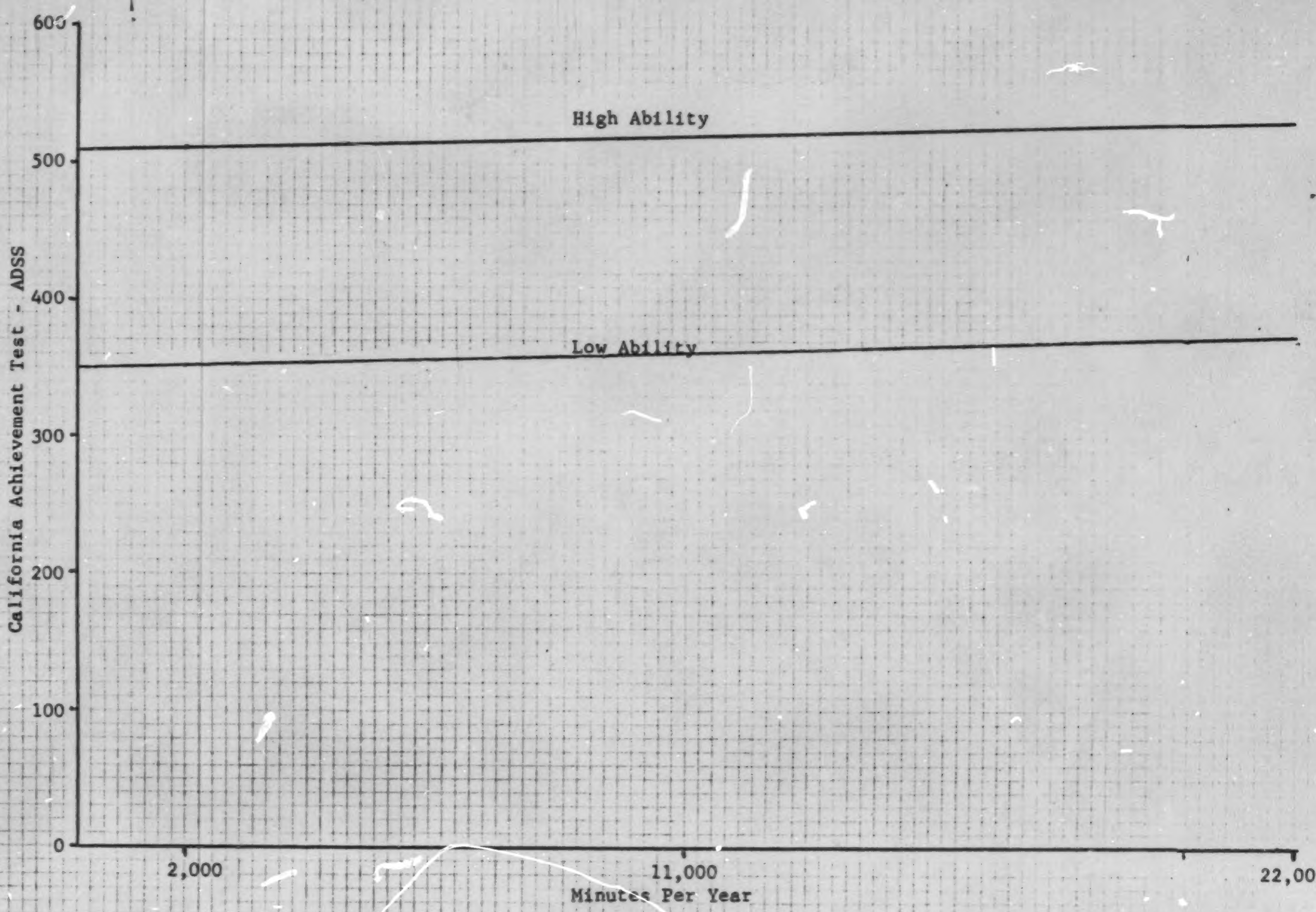


Table 9.31   Regression Analysis of Achievement on Total Specialist Time in District B - Model 2

```
SAMPLE SIZE      947
NO. OF VARIABLES  5        NO. OF VARIABLES DELETED  7  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.6430
MULTIPLE CORR. COEFFICIENT    0.8018

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3155451.52258
SUM OF SQUARES OF DEVIATION FROM REGRESSION  1752271.18835

VARIANCE OF ESTIMATE     1860.16050
STD. ERROR OF ESTIMATE     43.12958

INTERCEPT (A VALUE)    429.11973


          ANALYSIS OF VARIANCE FOR THE MULTIPLE
                      LINEAR  REGRESSION
   SOURCE OF VARIATION          D.F.      SUM OF          MEAN          F
                                          SQUARES         SQUARES       VALUE
DUE TO REGRESSION.............    4   3155451.52258   788862.88064   424.0832
DEVIATION ABOUT REGRESSION...   942   1752271.18835     1860.16050
                     TOTAL...   946   4907722.71093


VARIABLE      MEAN        STD.         REG.       STD.ERROR     COMPUTED     PARTIAL       SUM OF SQ.     PROP. VAR.
  NO.                  DEVIATION      COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED          CUM.
   3        0.30834     0.46205     88.10219     3.27474     26.90358     0.65917    2406074.82324     0.49026
   6        0.21542     0.41133    -67.39554     4.12257    -16.34794    -0.47011     725137.68945     0.14775
   7        0.33935     3.20501     -1.20983     0.43479     -2.78258    -0.09029      14402.79305     0.00293
   8        3.47378    13.42598     -0.27624     0.12013     -2.29953    -0.07471       9836.21643     0.00200
   1      440.39764    72.02085

COMP. CHECK ON FINAL COEFF.        -0.27624

VARIABLES DELETED...  2  4  5  9 10 11 12
```

Figure 9.19 Effect of Total Specialist Time on Achievement in District B - Model 2

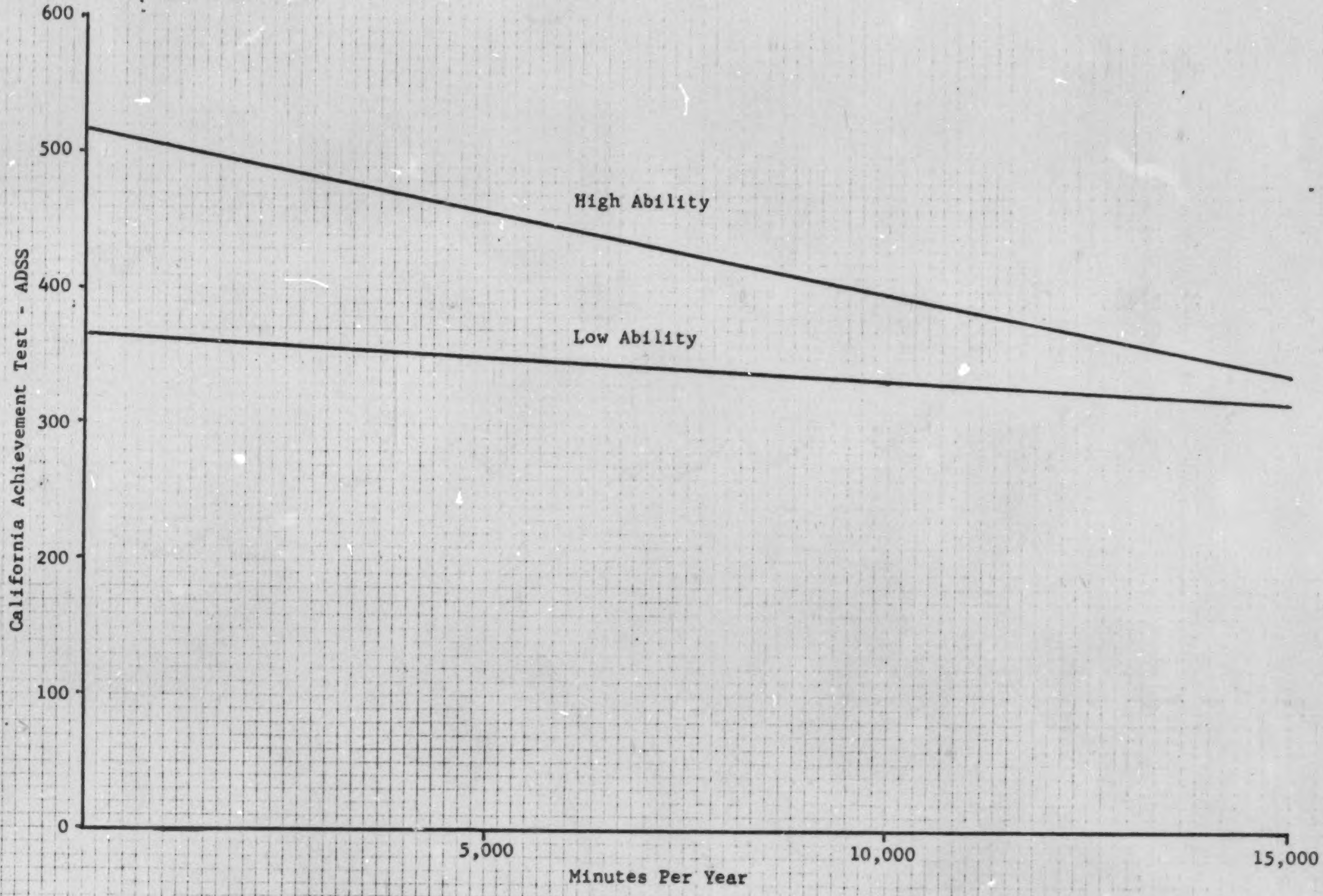


Table 9.32 Regression Analysis of Achievement on Total Paid Aide Time in District B - Model 3

```
SAMPLE SIZE       947
NO. OF VARIABLES   4       NO. OF VARIABLES DELETED   8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.6432
MULTIPLE CORR. COEFFICIENT    0.8051

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION      3181364.80432
SUM OF SQUARES OF DEVIATION FROM REGRESSION   1726357.90661

VARIANCE OF ESTIMATE        1830.70828
STD. ERROR OF ESTIMATE        42.78678

INTERCEPT (A VALUE)    429.11973


            ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
      SOURCE OF VARIATION         D.F.        SUM OF          MEAN            F
                                             SQUARES         SQUARES        VALUE
DUE TO REGRESSION.............      3   3181364.80432  1060454.93475    579.2594
DEVIATION ABOUT REGRESSION...     943   1726357.90661     1830.70828
                     TOTAL...     946   4907722.71093


VARIABLE      MEAN         STD.         REG.      STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                    DEVIATION     COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED         CUM.
   3        0.30834      0.46205     87.39365      3.21604     27.17427      0.66273    2406074.82324    0.49026
   6        0.21542      3.41133    -64.15771      3.89786    -16.45974     -0.47242     725137.68945    0.14775
  11        2.94734     12.59789     -0.62740      0.11987     -5.23403     -0.18802      50152.29163    0.01022
   1      440.39734     72.02685

CORP. CHECK ON FINAL COEFF.         -0.62740

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.20 Effect of Total Paid Aide Time on Achievement in District B - Model 3

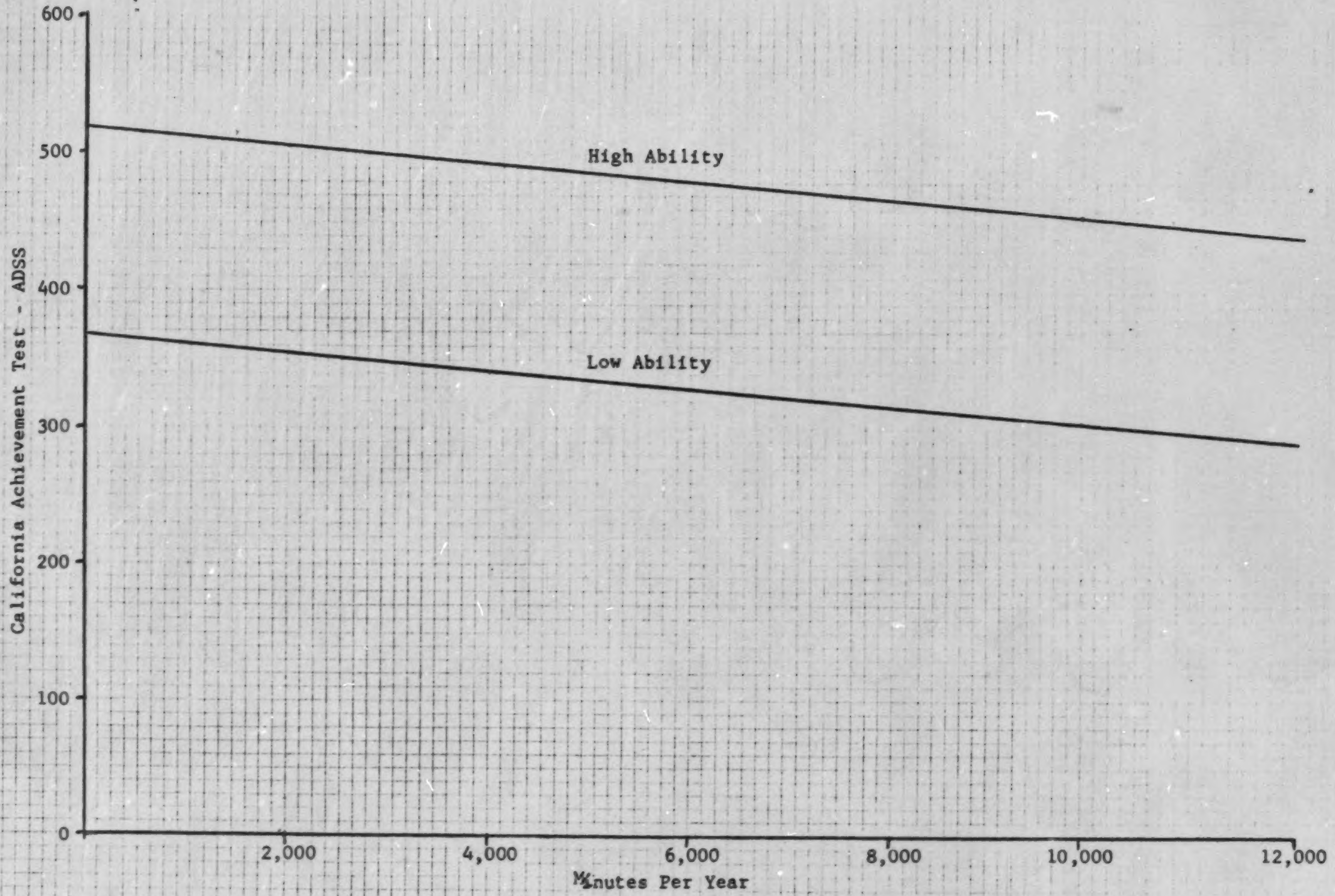


Table 9.33 Regression Analysis of Achievement on Total Individualized Instruction in District B - Model 2

```
SAMPLE SIZE      947
NO. OF VARIABLES  5       NO. OF VARIABLES CELETED  7  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.6429
MULTIPLE CORR. COEFFICIENT    0.8018

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3155252.32335
SUM OF SQUARES OF DEVIATION FROM REGRESSION  1752470.38761

VARIANCE OF ESTIMATE      1860.37196
STD. ERROR OF ESTIMATE      43.13233

INTERCEPT (A VALUE)    429.11973


            ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION        D.F.        SUM OF          MEAN           F
                                            SQUARES         SQUARES        VALUE
DUE TO REGRESSION.............    4    3155252.32335   788813.08076   424.0083
DEVIATION ABOUT REGRESSION...   942    1752470.38761     1860.37196
                     TOTAL...   946    4907722.71093


VARIABLE      MEAN         STD.         REG.       STD.ERROR     COMPUTED      PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                    DEVIATION     COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED         CUM.
   3         0.30834     0.46205     89.33446      3.35037     26.66643      0.65587    2406074.82324    0.49026
   6         0.21542     0.41133    -68.07298      4.11369    -16.54790     -0.47458     725137.68945    0.14775
   7         1.08966     6.03752     -0.72551      0.24126     -3.00717     -0.09751      16823.49301    0.00343
   8         4.39717    17.12542     -0.18504      0.09395     -1.96951     -0.06404       7216.31727    0.00147
   1       440.39704    72.02685

COMP. CHECK ON FINAL COEFF.          -0.18504

VARIABLES DELETED...  2  4  5  9 10 11 12
```

Figure 9.21 Effect of Total Individualized Instruction Time on Achievement in District B - Model 2

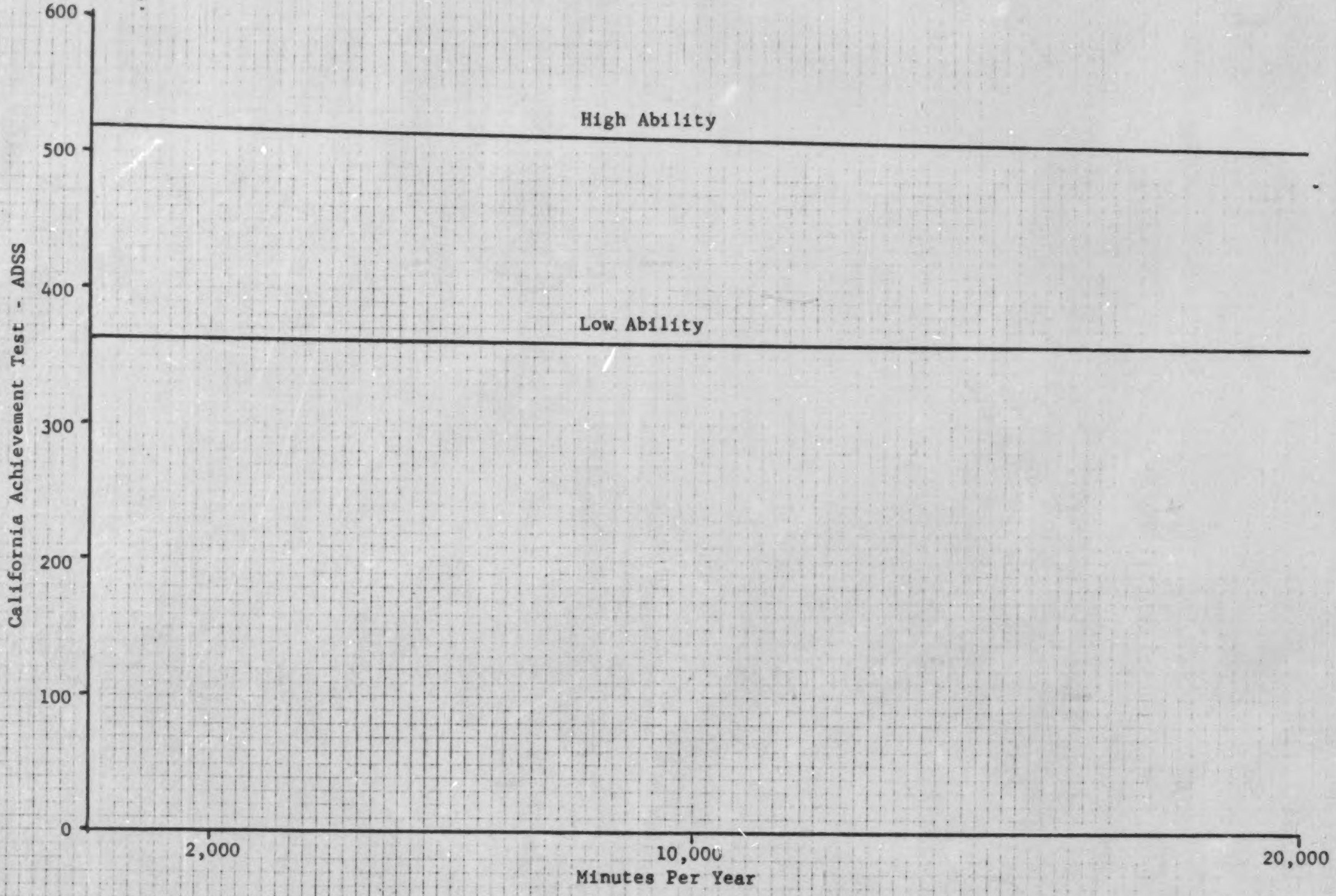


Table 9.34 Regression Analysis of Achievement on Total Teacher Time in District C - Model 1

```
SELECTION NO.    5- 1

SAMPLE SIZE      967
NO. OF VARIABLES  7      NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.5712
MULTIPLE CORR. COEFFICIENT    0.7558

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3060369.37750
SUM OF SQUARES OF DEVIATION FROM REGRESSION  2297164.29431

VARIANCE OF ESTIMATE     2392.87947
STD. ERROR OF ESTIMATE     48.91707

INTERCEPT (A VALUE)    416.23846


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.       SUM OF          MEAN          F
                                           SQUARES        SQUARES       VALUE
DUE TO REGRESSION............    6   3060369.37750   510061.56292   213.1581
DEVIATION ABOUT REGRESSION...  960   2297164.29431     2392.87947
                     TOTAL...  966   5357533.67187


VARIABLE      MEAN         STD.         REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
   3         0.09514     0.29356    41.70893    38.71434      1.07736     0.03475   2183495.21301   0.40756
   6         0.48811     0.50012   -73.18989     8.41469     -8.69787    -0.27027    819859.01969   0.15303
   7        11.72408    37.83088     1.75573     0.61973      2.83305     0.09106      3827.57123   0.00071
   8        54.02029    66.82037     0.04528     0.15582      0.29061     0.00938     27541.64205   0.00514
   9      1557.14974  5590.41091    -0.00785     0.00245     -3.20884    -0.10301     24638.58776   0.00460
  10      7378.53577 11342.06013     0.00045     0.00069      0.64882     0.02094      1007.33029   0.00019
   1       398.51955    74.47215

COMP. CHECK ON FINAL COEFF.        0.00045

VARIABLES DELETED...  2  4  5 11 12
```

Figure 9.22 Effect of Total Teacher Time on Achievement in District C - Model 1

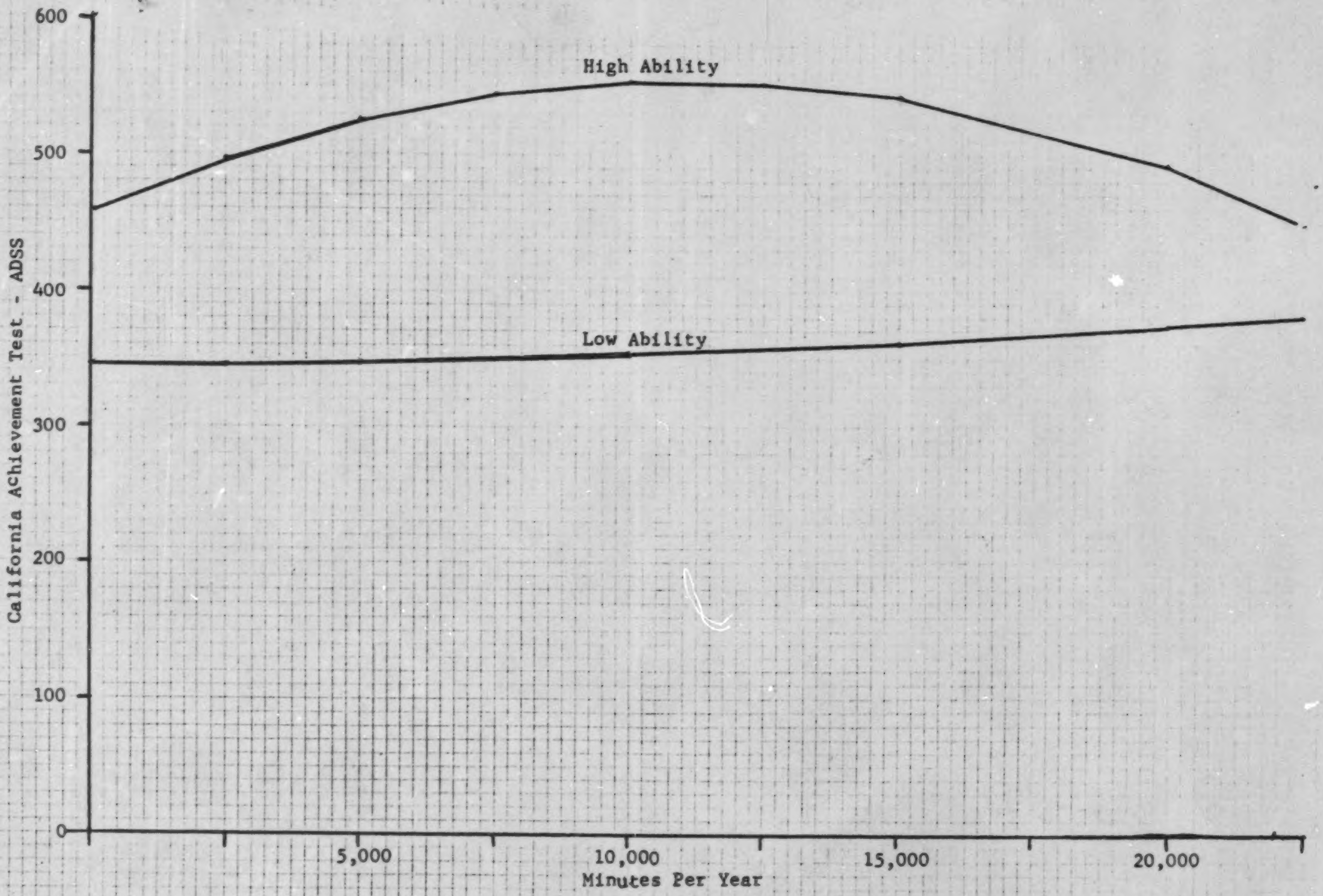


Table 9.35 Regression Analysis of Achievement on Whole Group Teacher Time in District C - Model 3

```
SAMPLE SIZE     967
NO. OF VARIABLES  4      NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.5609
MULTIPLE CORR. COEFFICIENT    0.7489

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     3005080.59143
SUM OF SQUARES OF DEVIATION FROM REGRESSION   2352453.08044

VARIANCE OF ESTIMATE     2442.83809
STD. ERROR OF ESTIMATE     49.42508

INTERCEPT (A VALUE)   416.23846


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION       D.F.     SUM OF          MEAN          F
                                        SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............    3  3005080.59143 1001693.53047   410.0532
DEVIATION ABOUT REGRESSION...   963  2352453.08044    2442.83809
                     TOTAL...   966  5357533.67187


VARIABLE     MEAN        STD.        REG.      STD.ERROR     COMPUTED      PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                  DEVIATION    COEFF.    OF REG.COE.    T VALUE     CORR. COE.      ADDED         CUM.
   3       0.59514     0.29356   127.37697     5.96560     21.35193      0.56684   2183495.21301   0.40756
   6       0.48811     0.50012   -62.68465     3.67839    -17.04132     -0.48135    819859.01969   0.15303
  11      21.25169    41.53080     0.03573     0.04250      0.84066      0.02708      1726.35856   0.00032
   1     398.51955    74.47215

COMP. CHECK ON FINAL COEFF.        0.03573

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.23 Effect of Whole Group Teacher Time on Achievement in District C - Model 3

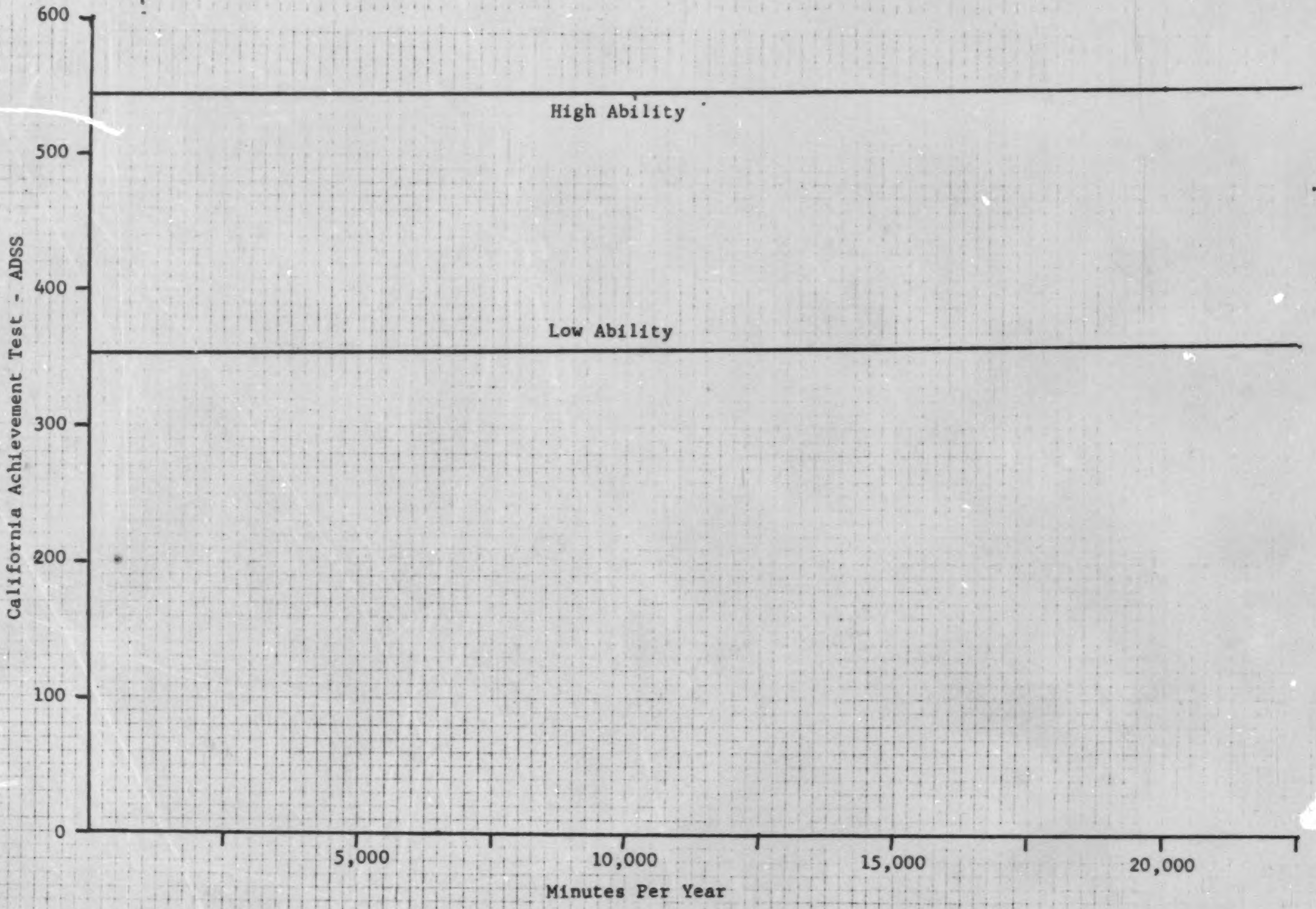


Table 9.36 Regression Analysis of Achievement on Small Group Teacher Time in District C - Model 1

```
SAMPLE SIZE      967
NO. OF VARIABLES  7      NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION   0.5693
MULTIPLE CORR. COEFFICIENT     0.7545

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3049921.73413
SUM OF SQUARES OF DEVIATION FROM REGRESSION  2307611.93774

VARIANCE OF ESTIMATE     2403.76244
STD. ERROR OF ESTIMATE     49.02818

INTERCEPT (A VALUE)   416.23846


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                        LINEAR  REGRESSION
       SOURCE OF VARIATION        D.F.     SUM OF        MEAN          F
                                          SQUARES      SQUARES       VALUE
DUE TO REGRESSION............     6  3049921.73413  508320.28903  211.4686
DEVIATION ABOUT REGRESSION...   960  2307611.93774    2403.76244
                     TOTAL...   966  5357533.67187


VARIABLE      MEAN         STD.          REG.      STD.ERROR     COMPUTED     PARTIAL      SUM OF SQ.    PROP. VAR.
  NO.                    DEVIATION      COEFF.    OF REG.COE.    T VALUE    CORR. COE.       ADDED          CUM.
   3        0.29514      0.29356    110.53010     14.40337      7.67391      0.24041   2183495.21301    0.40756
   6        0.48811      0.50012    -60.65133      4.89278    -12.39608     -0.37146    819859.01969    0.15303
   7        7.75078      2[illegible].13871      0.84402      0.31544      2.67568      0.08634      2809.23606    0.00352
   8       31.07320     49.59091     -0.18866      0.13036     -1.44723     -0.04666      6277.64831    0.00117
   9      795.82239   3334.44510     -0.00603      0.00179     -3.36320     -0.10791     27189.12321    0.00507
  10     3422.75848   7290.22315      0.00163      0.00078      2.06915      0.06663     10291.43505    0.00192
   1      398.51955     74.47215

COMP. CHECK ON FINAL COEFF.          0.00160

VARIABLES DELETED...  2  4  5 11 12
```

Figure 9.27 Effect of Small Group Teacher Time on Achievement in District C - Model 1

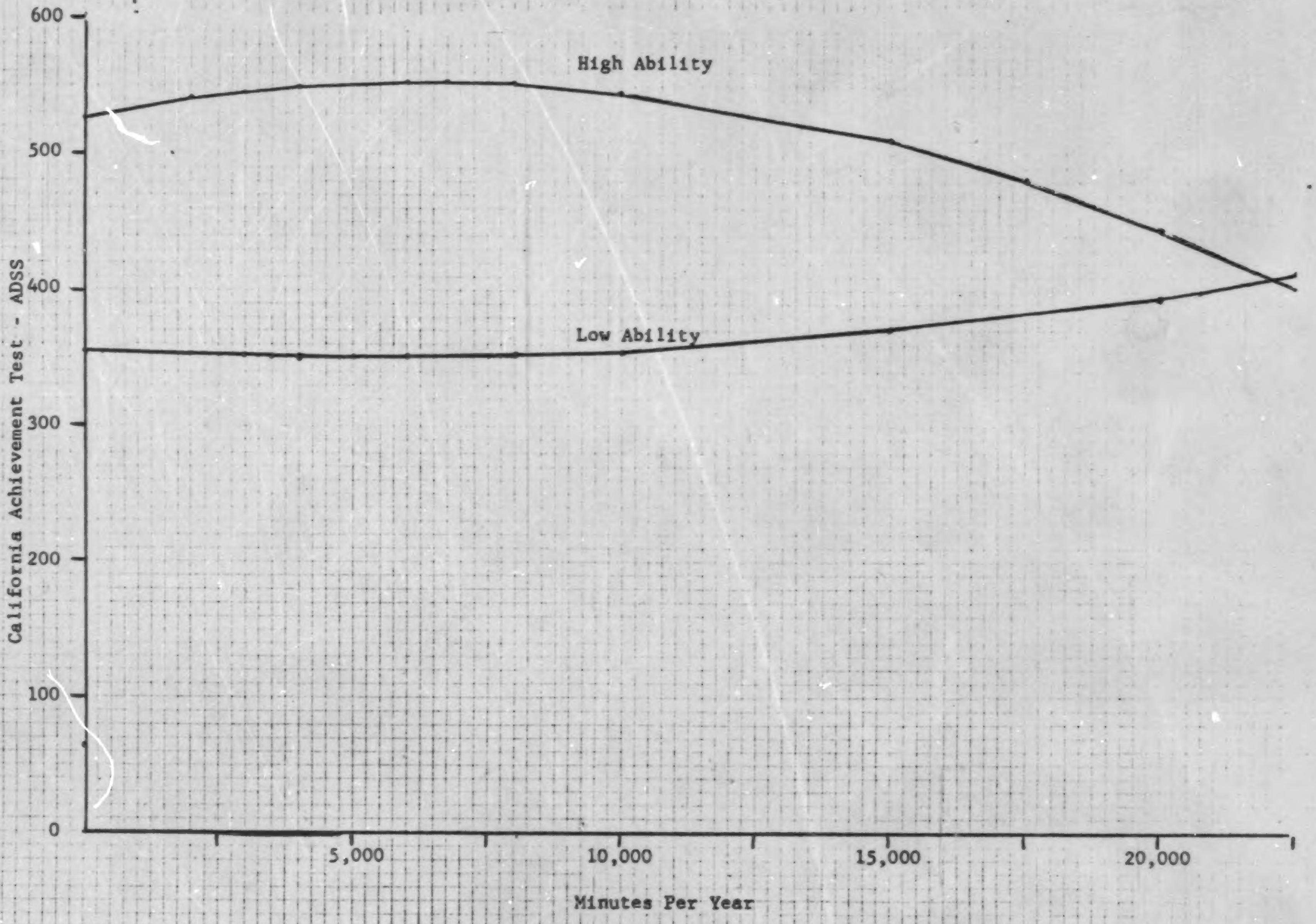


Table 9.37 Regression Analysis of Achievement on Total Specialist Time in District C - Model 2

```
SAMPLE SIZE     967
NO. OF VARIABLES  5       NO. OF VARIABLES DELETED  7  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.8177
MULTIPLE CORR. COEFFICIENT    0.9043

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    4381044.75512
SUM OF SQUARES OF DEVIATION FROM REGRESSION   976488.91674

VARIANCE OF ESTIMATE     1015.06124
STD. ERROR OF ESTIMATE     31.86033

INTERCEPT (A VALUE)   406.57482

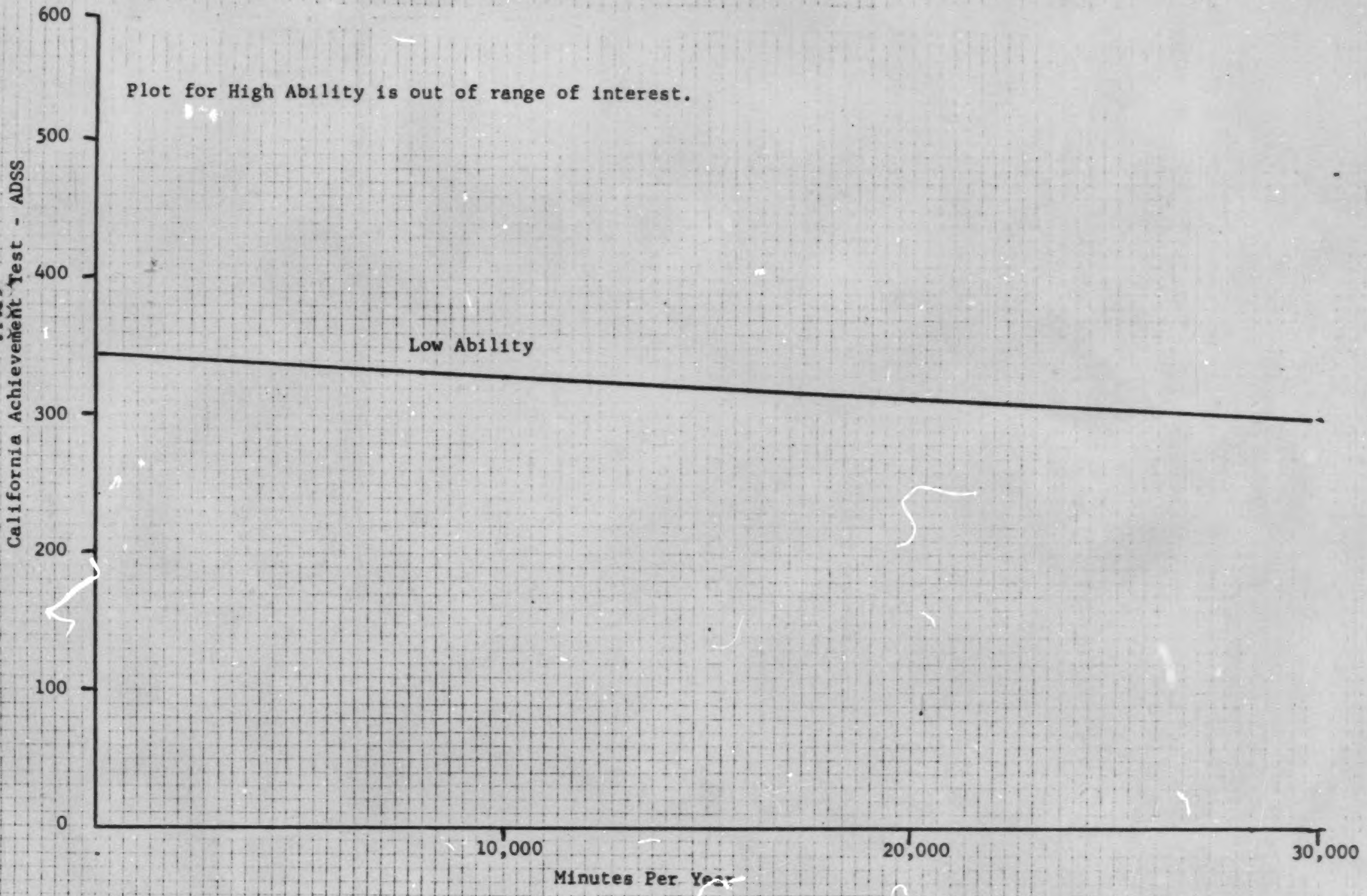

                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                           LINEAR  REGRESSION
          SOURCE OF VARIATION        D.F.      SUM OF        MEAN          F
                                               SQUARES       SQUARES       VALUE
DUE TO REGRESSION............     4  4381044.75512 1095261.18878  1079.0100
DEVIATION ABOUT REGRESSION...   962   976488.91674    1015.06124
                     TOTAL...   966  5357533.67187


VARIABLE      MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL     SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
   3        0.09514      0.29356  642.16066     0.00000      0.00000     0.00000  2183495.21331    0.40756
   6        0.48011      0.50012  -59.83783     2.23018    -26.83100    -0.48735   819859.01969    0.15303
   7        0.00951      0.02936-4117.63659     0.00000      0.00000     0.00000       -0.00123   -0.00000
   8        4.02734     18.24162   -0.16600     0.05819     -2.85254    -0.05923     8259.54064    0.00154
   1      398.51955     74.47215

COMP. CHECK ON FINAL COEFF.        -0.16600

VARIABLES DELETED...  2  4  5  9 10 11 12
```

Figure 9.25 Effect of Total Specialist Time on Achievement in District C - Model 2



Plot for High Ability is out of range of interest.

Table 9.38 Regression Analysis of Achievement on Total Paid Aide Time in District C- Model 3

```
SELECTION NO.    6- 3

SAMPLE SIZE      967
NO. OF VARIABLES  4       NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION__0.5637
MULTIPLE CORR. COEFFICIENT    0.7508

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3019982.55566
SUM OF SQUARES OF DEVIATION FROM REGRESSION  2337551.11621

VARIANCE OF ESTIMATE    2427.36357
STD. ERROR OF ESTIMATE    49.26828

INTERCEPT (A VALUE)    416.23846


             ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION       D.F.      SUM OF          MEAN          F
                                         SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............    3  3019982.55566 1006660.85188   414.7137
DEVIATION ABOUT REGRESSION..._963  2337551.11621    2427.36357
                    TOTAL...  966  5357533.67187


VARIABLE      MEAN        STD.        REG.     STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                  DEVIATION     COEFF.   OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
   3         0.29514     0.29356  128.86212     5.69279    22.63604     0.58931  2183495.21301    0.40756
   6         0.48811     0.50012  -58.99560     3.46672   -17.01780    -0.48084   819859.01969    0.15303
  11         8.49793    31.04504   -0.13916     0.05317    -2.61732    -0.08404    16628.32293    0.00310
   1       398.51955    74.47215

COMP. CHECK ON FINAL COEFF.       -0.13916

VARIABLES DELETED...  2   4   5   7   8   9  10  12
```

Figure 9.26 Effect of Total Paid Aide Time on Achievement in District C - Model 3

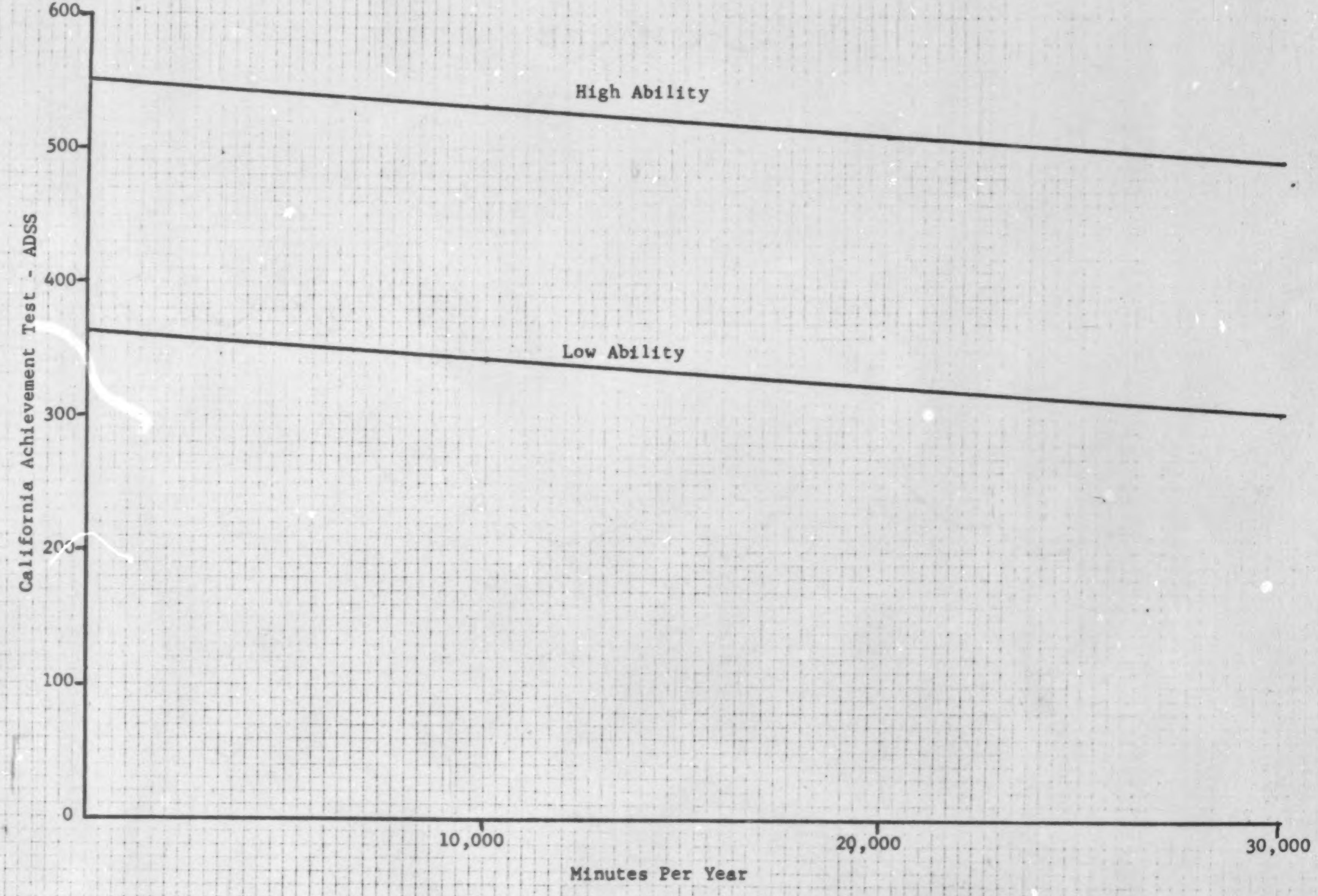


Table 9.39 Regression Analysis of Achievement on Individualized Instruction Time in District C - Model 3

```
SAMPLE SIZE     967
NO. OF VARIABLES  4      NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION__0.5606_________________________________________________
MULTIPLE CORR. COEFFICIENT    0.7487

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    3003388.46148
SUM OF SQUARES OF DEVIATION FROM REGRESSION  2354145.21032

VARIANCE OF ESTIMATE    2444.59523
STD. ERROR OF ESTIMATE    49.44285

INTERCEPT (A VALUE)   416.23846


                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
       SOURCE OF VARIATION      D.F.      SUM OF         MEAN           F
                                          SQUARES        SQUARES        VALUE
DUE TO REGRESSION............    3   3003388.46148 1001129.48716   409.5277
DEVIATION ABOUT REGRESSION...  963   2354145.21032    2444.59523
                     TOTAL...  966   5357533.67187


VARIABLE      MEAN         STD.        REG.      STD.ERROR    COMPUTED      PARTIAL     SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION     COEFF.   OF REG.COE.   T VALUE     CORR. COE.     ADDED        CUM.
   3        0.09514      0.29356   128.83423    5.71329     22.54992      0.58785  2183495.21301    0.40756
   6        0.48811      0.50012   -61.29780    3.48846    -17.57158     -0.49273   819859.01969    0.15303
  11        9.32025     32.56074    -0.00603    0.05099     -0.11833     -0.00381       34.22601    0.00001
   1      398.51955     74.47215

COMP. CHECK ON FINAL COEFF.      -0.00603

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.27 Effect of Individualized Instruction Time on Achievement in District C - Model 3

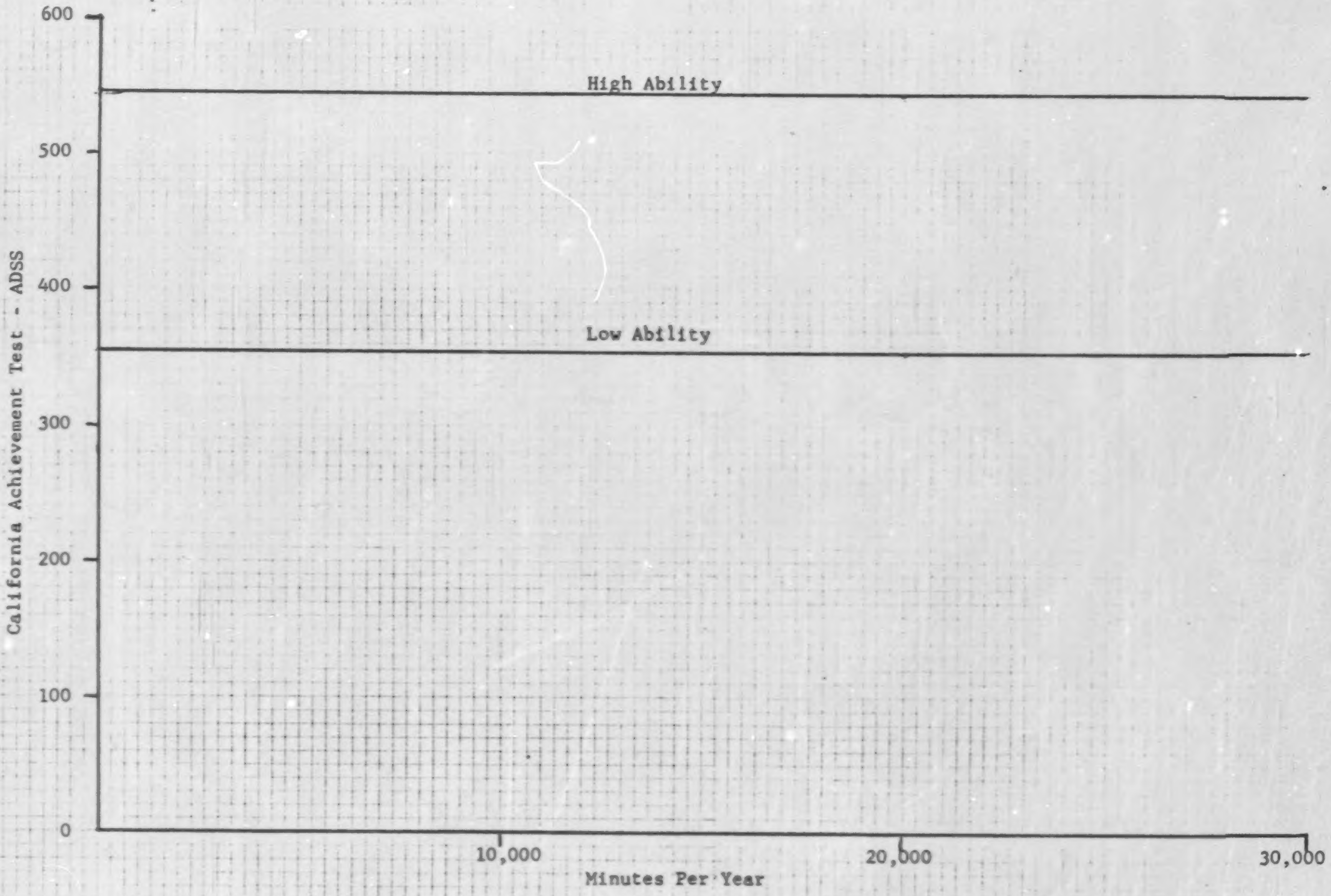


Table 9.40 Regression Analysis of Achievement on Total Teacher Instruction Time in District D - Model 2

```
SAMPLE SIZE      523
NO. OF VARIABLES  5       NO. OF VARIABLES DELETED  7  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7074
MULTIPLE CORR. COEFFICIENT    0.8411

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2066651.52722
SUM OF SQUARES OF DEVIATION FROM REGRESSICN    854641.99621

VARIANCE OF ESTIMATE     1649.88802
STD. ERROR OF ESTIMATE     40.61881

INTERCEPT (A VALUE)    426.97650


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.       SUM OF         MEAN          F
                                            SQUARES        SQUARES       VALUE
DUE TO REGRESSION.............    4  2066651.52722  516662.88101   313.1503
DEVIATION ABOUT REGRESSION...   518   854641.99621    1649.88802
                     TOTAL...   522  2921293.52343


VARIABLE      MEAN          STD.         REG.      STD.ERROR      COMPUTED      PARTIAL      SUM OF SQ.     PROP. VAR.
  NO.                    DEVIATION      COEFF.    OF REG.COE.     T VALUE     CORR. COE.      ADDED           CUM.
   3        0.23901       0.42688    106.04432     7.96044      13.32142      0.50514   1409005.60443     0.48232
   6        0.31358       0.46439    -89.86980     6.68865     -13.43617     -0.50837    641192.65417     0.21949
   7       22.44263      47.46668     -0.19106     0.06993      -2.73218     -0.11919     12316.11666     0.00422
   8       30.66830      56.18849      0.08510     0.05374       1.58352      0.06941      4137.15182     0.00142
   1      422.46272      74.80874

COMP. CHECK ON FINAL COEFF.         0.08510

VARIABLES DELETED...  2  4  5  9 10 11 12
```

Figure 9.28 Effect of Total Teacher Instruction Time on Achievement in District D - Model 2

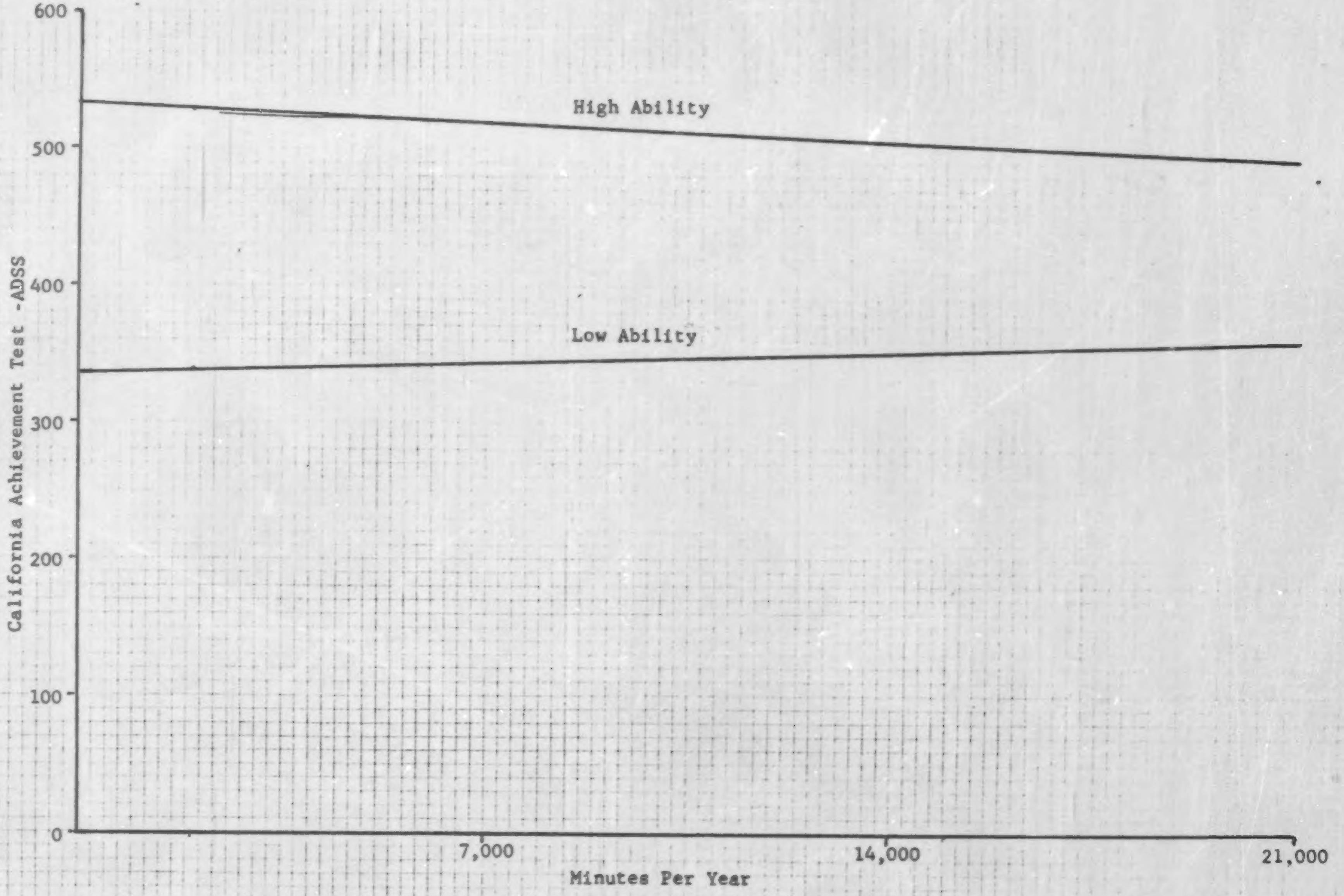


Table 9.41 Regression Analysis of Achievement of Whole Group Teacher Time in District D - Model 3

```
SAMPLE SIZE      523
NO. OF VARIABLES  4       NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7079
MULTIPLE CORR. COEFFICIENT    0.8414

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2068052.27224
SUM OF SQUARES OF DEVIATION FROM REGRESSION    853241.25115

VARIANCE OF ESTIMATE     1644.01012
STD. ERROR OF ESTIMATE     40.54639

INTERCEPT (A VALUE)    426.97650


              ANALYSIS OF VARIANCE FOR THE MULTIPLE
                     LINEAR  REGRESSION
    SOURCE OF VARIATION          D.F.      SUM OF         MEAN          F
                                          SQUARES       SQUARES      VALUE
DUE TO REGRESSION.............   3  2068052.27224  689350.75741   419.3105
DEVIATION ABOUT REGRESSION...  519   853241.25115    1644.01012
                     TOTAL...  522  2921293.52343


VARIABLE      MEAN         STD.          REG.      STD.ERROR      COMPUTED      PARTIAL       SUM OF SQ.    PROP. VAR.
  NO.                   DEVIATION      COEFF.    OF REG.COE.    T VALUE     CORR. COE.       ADDED          CUM.
   3        0.23931      0.42688     82.02984      4.85536      16.89468      0.59567   1409005.60443     0.48232
   6        0.31358      0.46439    -87.33163      4.48684     -19.46395     -0.64958    641192.65417     0.21949
  11        6.97519     13.98424      0.46819      0.14207       3.29546      0.14316     17854.01364     0.00611
   1      422.46272     74.80874

COMP. CHECK ON FINAL COEFF.         0.46819

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.29 Effect of Whole Group Teacher Instruction Time on Achievement in District D - Model 3

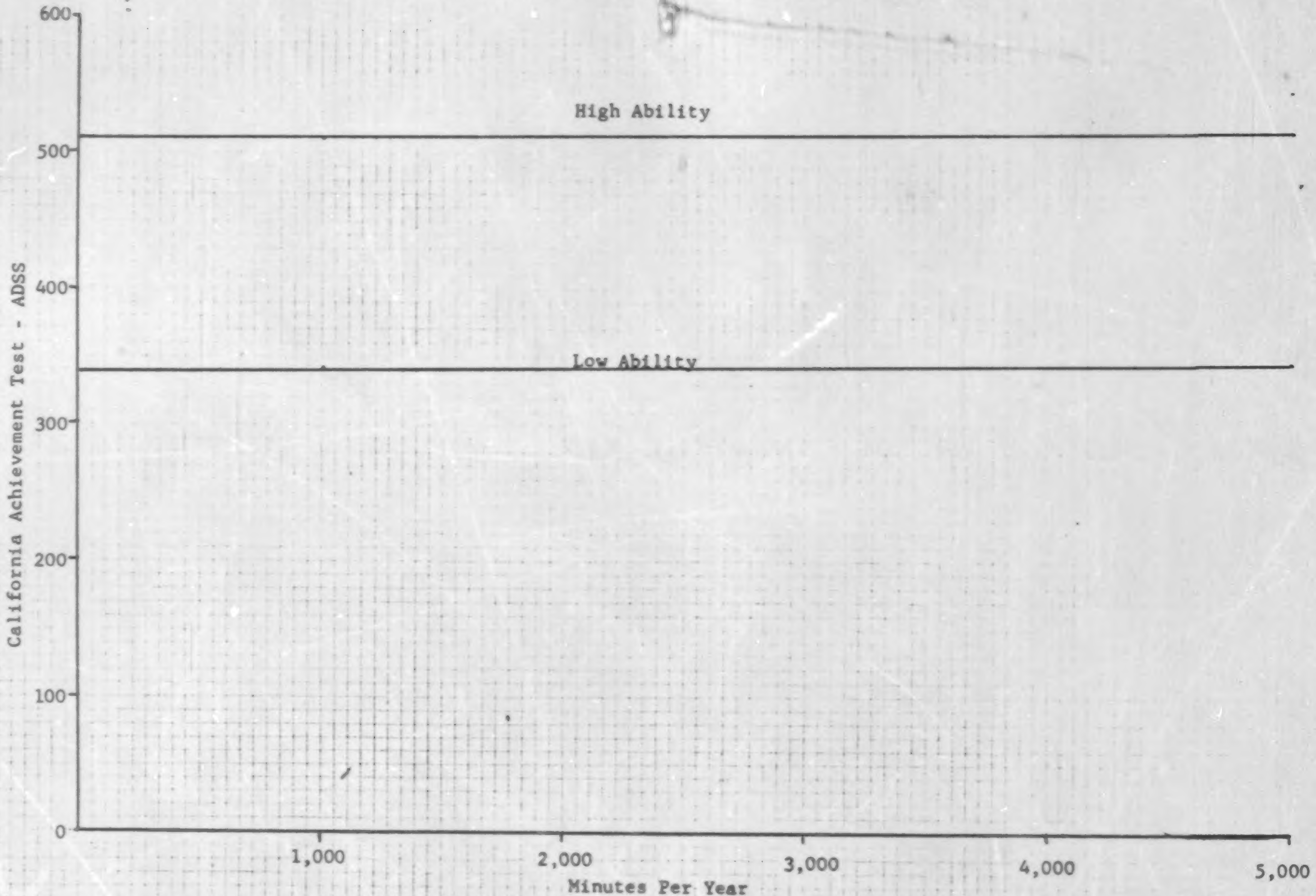


Table 9.42 Regression Analysis of Achievement on Total Small Group Instruction Time in District D - Model 2

```
SAMPLE SIZE     523
NO. OF VARIABLES  5      NO. OF VARIABLES DELETED  7  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7060
MULTIPLE CORR. COEFFICIENT    0.8402

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2062309.19238
SUM OF SQUARES OF DEVIATION FROM REGRESSION    858984.33105

VARIANCE OF ESTIMATE    1658.27091
STD. ERROR OF ESTIMATE    40.72187

INTERCEPT (A VALUE)   426.97650


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                         LINEAR  REGRESSION
      SOURCE OF VARIATION          D.F.     SUM OF         MEAN          F
                                           SQUARES        SQUARES      VALUE
DUE TO REGRESSION.............       4  2062309.19238  515577.29810  310.9126
DEVIATION ABOUT REGRESSION...      518   858984.33105    1658.27091
                     TOTAL...      522  2921293.52343


VARIABLE      MEAN        STD.        REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION    COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
   3        0.23901      0.42688    95.13700     5.42373     17.54089     0.61044   1409035.60443    0.48232
   6        0.31358      0.46439   -87.89970     6.25047    -14.06290    -0.52564    641192.65417    0.21949
   7       13.87570     42.37331    -0.12115     0.05186     -2.33620    -0.10211      9050.59082    0.00310
   8       25.84782     49.52027     0.07707     0.05673      1.35849     0.05958      3060.34310    0.00105
   1      422.46272     74.80874

COMP. CHECK ON FINAL COEFF.         0.07707

VARIABLES DELETED...  2  4  5  9  10  11  12
```

Figure 9.30 Effect of Total Small Group Instruction Time on Achievement in District D - Model 2

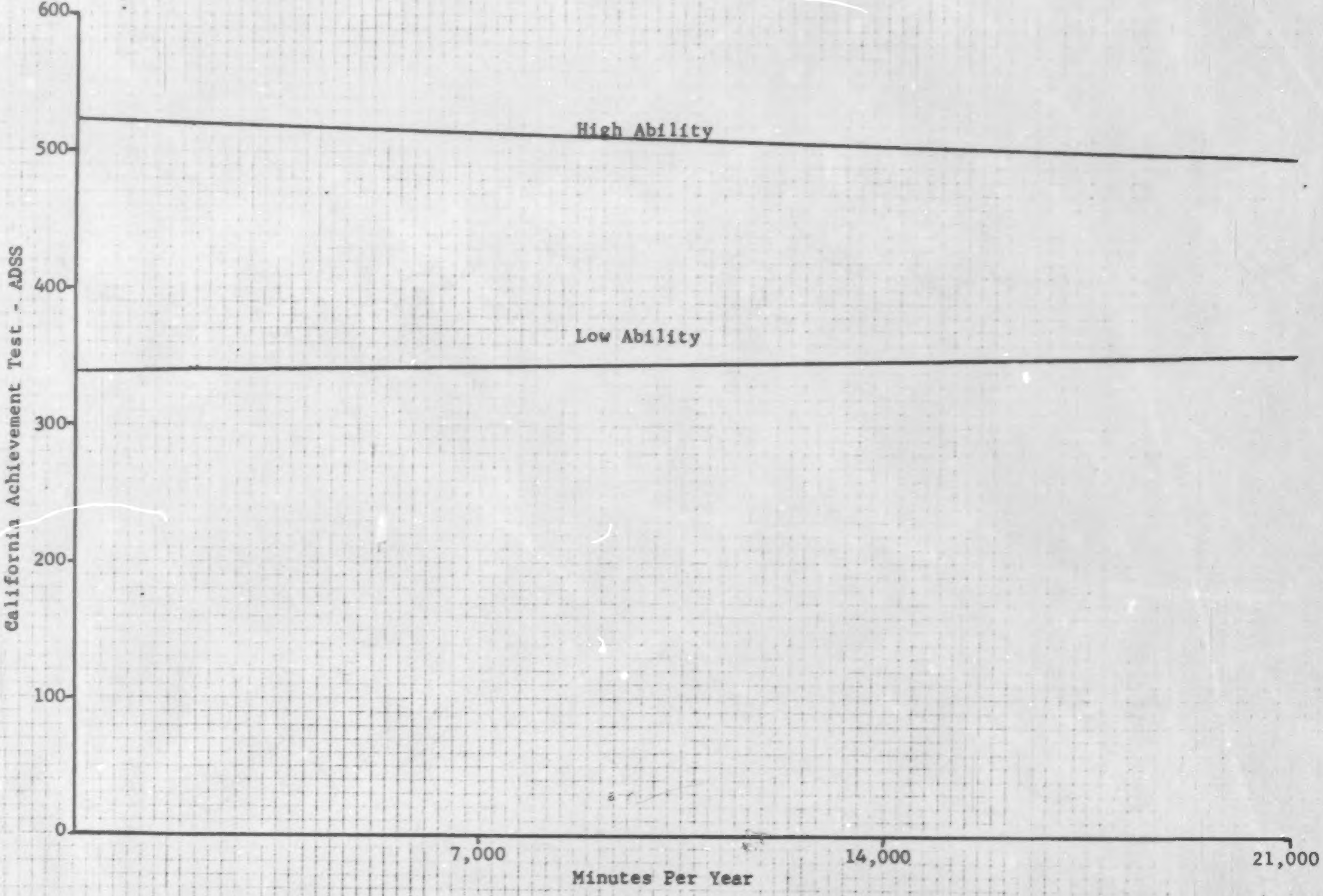


Table 9.43 Regression Analysis of Achievement on Total Specialist Time in District D - Model 1

```
SAMPLE SIZE      523
NO. OF VARIABLES  7      NO. OF VARIABLES DELETED  5  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7124
MULTIPLE CORR. COEFFICIENT    0.8440

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    2081149.42642
SUM OF SQUARES OF DEVIATION FROM REGRESSION   840144.09698

VARIANCE OF ESTIMATE    1628.18623
STD. ERROR OF ESTIMATE    40.35079

INTERCEPT (A VALUE)    426.97650


                ANALYSIS OF VARIANCE FOR THE MULTIPLE
                       LINEAR  REGRESSION
     SOURCE OF VARIATION         D.F.     SUM OF        MEAN          F
                                          SQUARES       SQUARES       VALUE
DUE TO REGRESSION:...........     6   2081149.42642  346858.23773   213.0335
DEVIATION ABOUT REGRESSION...   516    840144.09698    1628.18623
                    TOTAL...    522   2921293.52343


VARIABLE     MEAN         STD.        REG.      STD.ERROR    COMPUTED     PARTIAL       SUM OF SQ.     PROP. VAR.
 NO.                   DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.       ADDED          CUM.
  3        0.23901      0.42688     87.87069    4.60406     19.08548     0.64328   1409005.60443     0.48232
  6        0.31358      0.46439    -77.45385    4.62285    -16.75456    -0.59358    641192.65417     0.21949
  7        0.37697      3.02771      3.55214    1.51104      2.35079     0.10294      4990.45174     0.00171
  8        6.56716     22.66274     -0.20587    0.22987     -0.89558    -0.03943      8062.29268     0.00276
  9        9.29158    108.32521     -0.13813    0.04167     -3.31491    -0.14443     17891.51635     0.00612
 10      555.74548   2616.42173      0.00012    0.00189      0.06513     0.00287         6.90701     0.00003
  1      422.46272     74.80874

COMP. CHECK ON FINAL COEFF.          0.00012

VARIABLES DELETED...  2  4  5 11 12
```

Figure 9.31 Effect of Total Specialist Time on Achievement in District D - Model 1

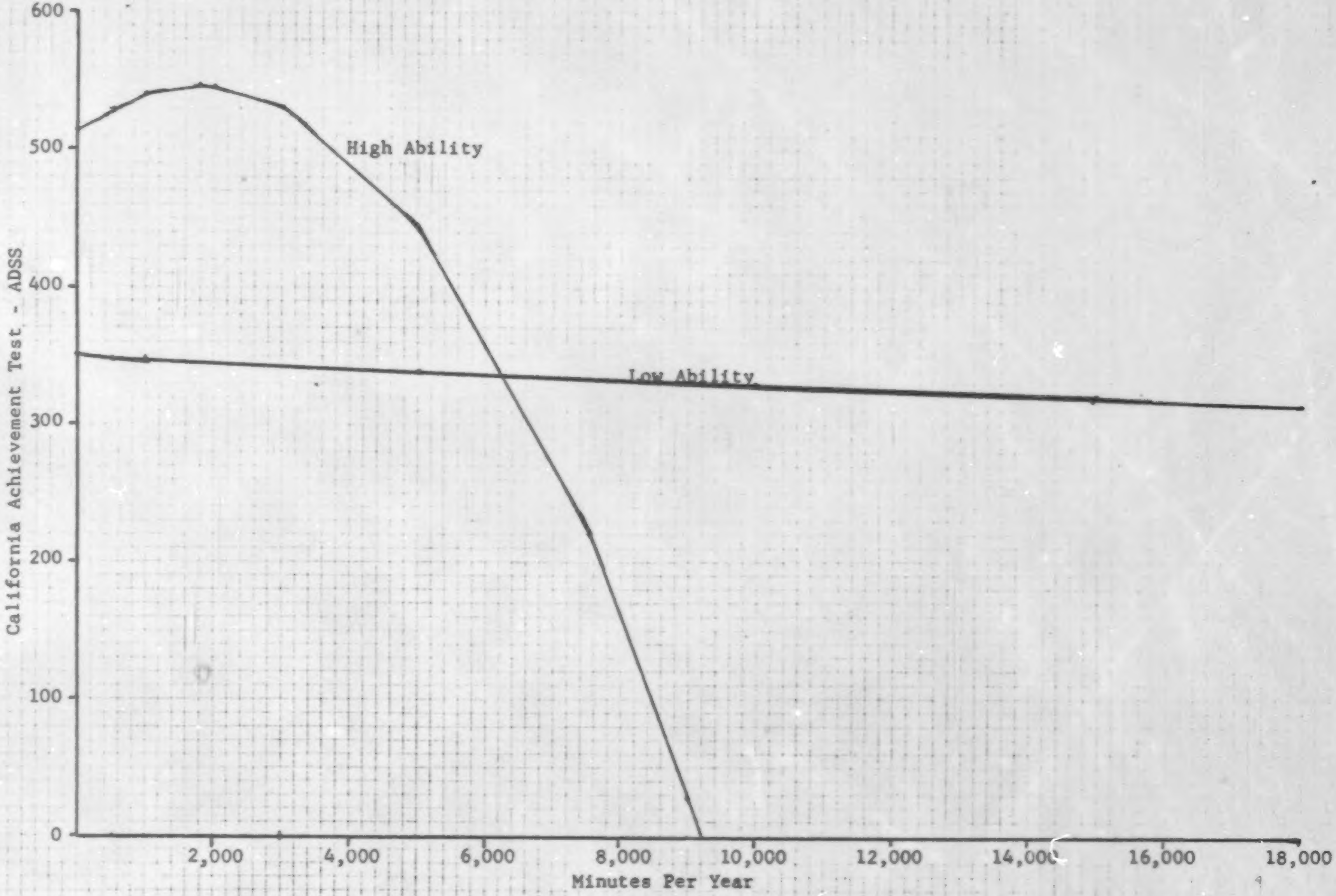


Table 9.44 Regression Analysis of Achievement on Paid Aide Instruction Time in District D - Model 3

```
SAMPLE SIZE     523
NO. OF VARIABLES  4     NO. OF VARIABLES DELETED  8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7019
MULTIPLE CORR. COEFFICIENT    0.8378

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION    2050462.89334
SUM OF SQUARES OF DEVIATION FROM REGRESSION   870830.63006

VARIANCE OF ESTIMATE     1677.90102
STD. ERROR OF ESTIMATE     40.96219

INTERCEPT (A VALUE)    426.97650


                 ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION          D.F.      SUM OF         MEAN         F
                                             SQUARES       SQUARES      VALUE
DUE TO REGRESSION.............     3  2050462.89334  683487.63110   407.3468
DEVIATION ABOUT REGRESSION...    519   870830.63006    1677.90102
                      TOTAL...   522  2921293.52343


VARIABLE      MEAN        STD.         REG.      STD.ERROR     COMPUTED     PARTIAL     SUM OF SQ.   PROP. VAR.
  NO.                   DEVIATION     COEFF.    OF REG.COE.    T VALUE    CORR. COE.     ADDED         CUM.
   3        0.23901     0.42688     88.06586     4.53902     19.40195     0.64838   1409005.60443    0.48232
   6        0.31358     0.46439    -81.85713     4.24417    -19.28698    -0.64614    641192.65417    0.21949
  11        1.46617     9.99968      0.07255     0.18267      0.39714     0.01743       264.63471    0.00009
   1      422.46272    74.83874

COMP. CHECK ON FINAL COEFF.         0.07255

VARIABLES DELETED...  2  4  5  7  8  9 10 12
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Figure 9.32 Effect of Paid Aide Instruction on Achievement in District D - Model 3

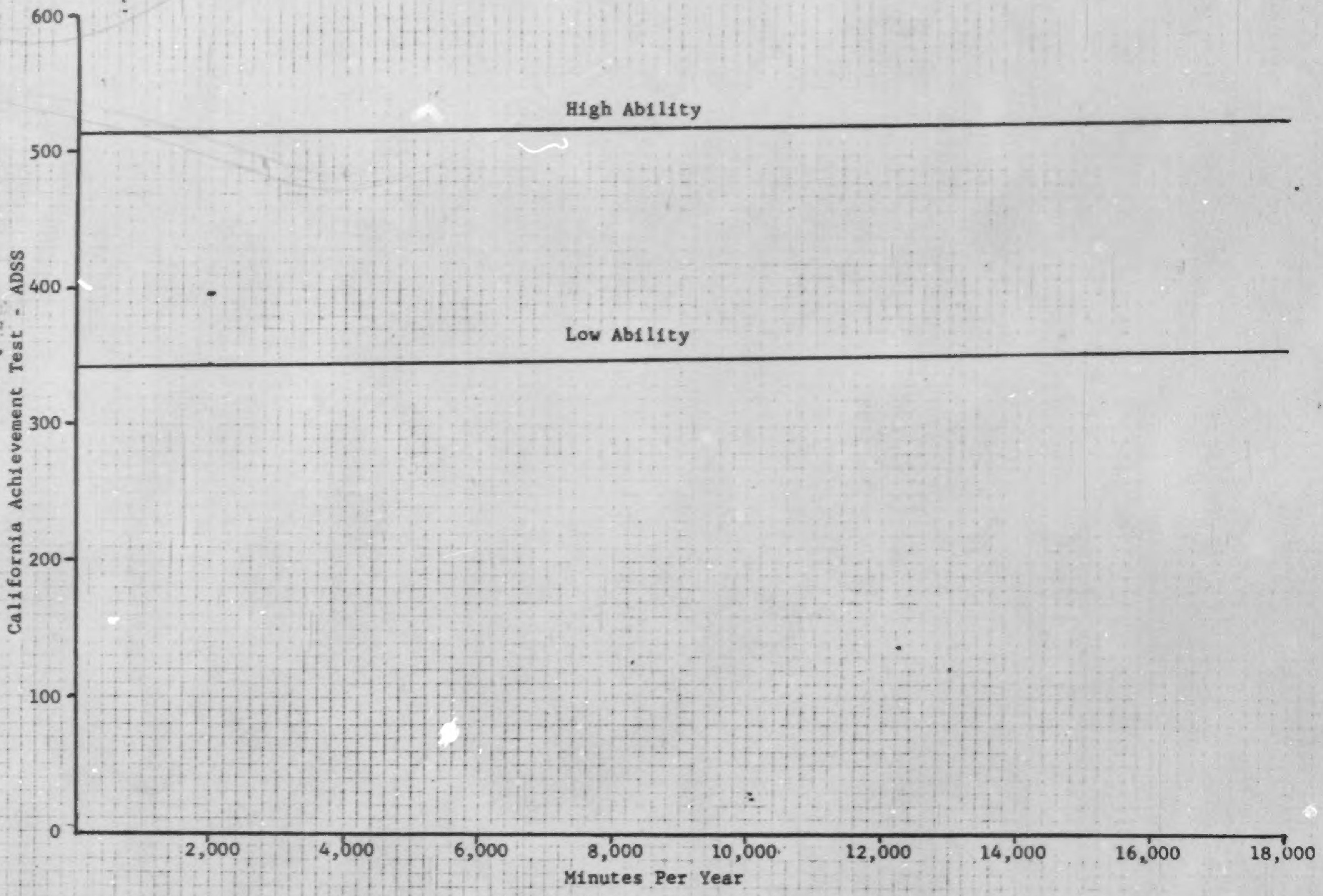


Table 9.45 Regression Analysis of Achievement on Total Individualized Instruction Time in District D - Model 3

```
SAMPLE SIZE      523
NO. OF VARIABLES  4       NO. OF VARIABLES DELETED   8  (FOR VARIABLES DELETED, SEE BELOW)
DEPENDENT VARIABLE IS NOW NO.  1

COEFFICIENT OF DETERMINATION  0.7048
MULTIPLE CORR. COEFFICIENT    0.8395

SUM OF SQUARES ATTRIBUTABLE TO REGRESSION     2058979.99453
SUM OF SQUARES OF DEVIATION FROM REGRESSION    862313.52886

VARIANCE OF ESTIMATE     1661.49042
STD. ERROR OF ESTIMATE     40.76138

INTERCEPT (A VALUE)    426.97650

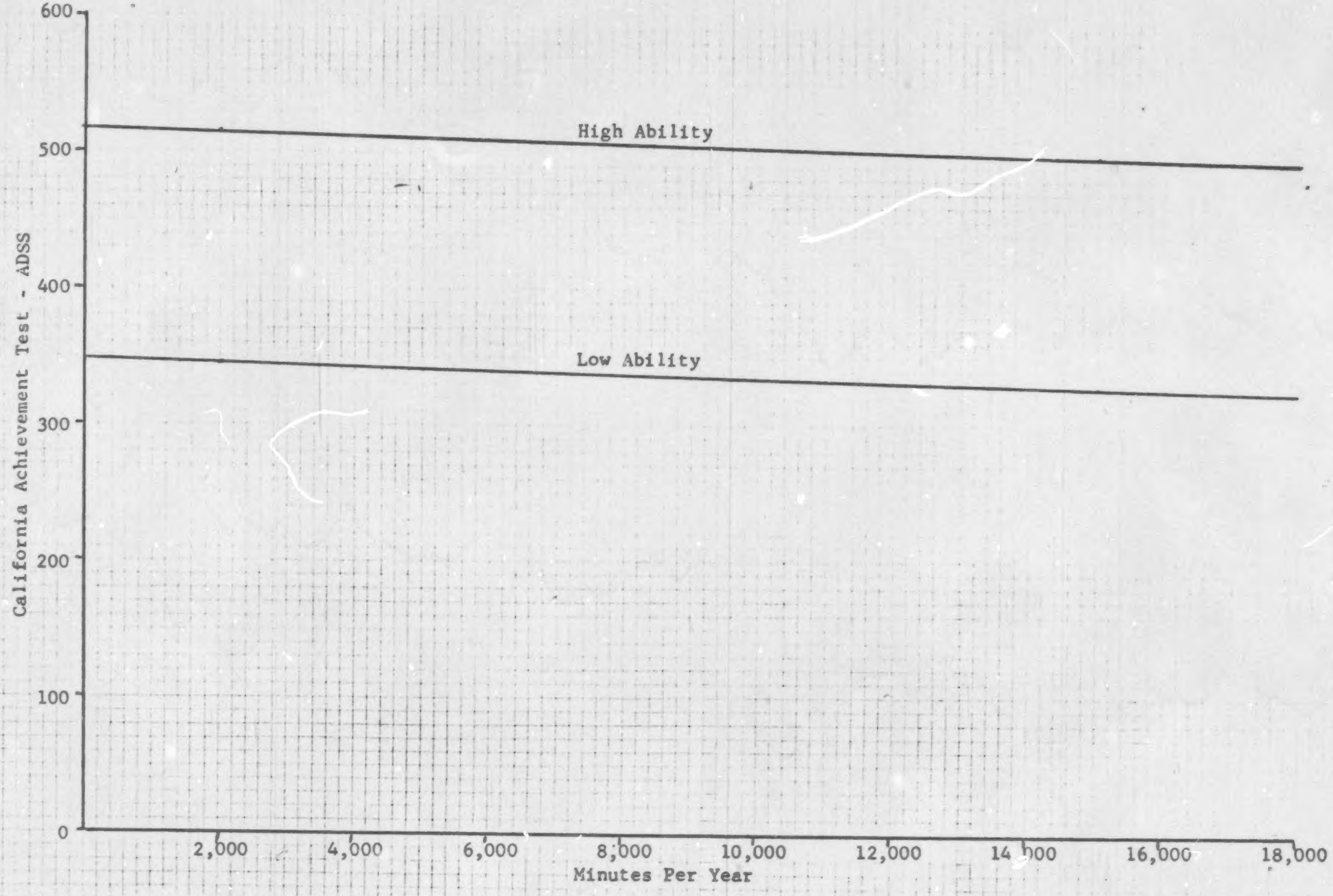

                  ANALYSIS OF VARIANCE FOR THE MULTIPLE
                          LINEAR  REGRESSION
      SOURCE OF VARIATION        D.F.      SUM OF         MEAN           F
                                          SQUARES        SQUARES       VALUE
DUE TO REGRESSION............      3  2058979.99453  686326.66484   413.0789
DEVIATION ABOUT REGRESSION...    519   862313.52886    1661.49042
                     TOTAL...    522  2921293.52343


VARIABLE      MEAN         STD.         REG.      STD.ERROR    COMPUTED     PARTIAL      SUM OF SQ.   PROP. VAR.
  NO.                    DEVIATION     COEFF.    OF REG.COE.   T VALUE    CORR. COE.      ADDED        CUM.
   3        0.23901      0.42688     91.31977     4.72752     19.31663     0.64672  1409035.60443    0.48232
   6        0.31358      0.46439    -78.65344     4.33764    -18.13278    -0.62276   641192.65417    0.21949
  11       11.68959     30.49583     -0.14337     0.06236     -2.29901    -0.10641     6781.73597    0.00301
   1      422.46272     74.80874

COMP. CHECK ON FINAL COEFF.         -0.14337

VARIABLES DELETED...  2  4  5  7  8  9 10 12
```

Figure 9.33 Effect of Total Individualized Instruction Time on Achievement in District D - Model 3



10.0 EFFECT OF COMPREHENSIVE ACHIEVEMENT MONITORING ON STUDENT LEARNING

Prepared by: Charles F. Adams
November, 1974

PREFACE

To conduct a research study in public education requires the cooperation and effort of a large number of people. Especially important are the attitude and willingness of school administrators to support and contribute to research efforts that generally require time and resources beyond normal operations. The contribution of people in the West Seneca Central School District to the study as reported is worthy of commendation.

There were so many people, teachers, clerical personnel and especially the students themselves of the West Seneca District who contributed to the research effort that to single out a few seems arbitrary. Nevertheless, I must hazard that risk and mention a few individuals without whose cooperation and effort the study could not have taken place. First, Dr. Carl Markello, Deputy Superintendent of Schools, whose leadership over the three years was extremely supportive. Rarely does one find a school administrator with the knowledge and passion for research of Dr. Markello. Both the principal and assistant principal of the Northwood Elementary School (Mr. Al Wolchuck and Mr. Steven Maricich, respectively) cooperated and supported the study in innumerable ways. Two of the finest teachers I have had the occasion to work with, Ms. Mary Alice Walz and Ms. Ann Wojiechowich, demonstrated that quality of dedication to the profession that is often overlooked these days. Without their hard work and patience with the researcher, the study could not have been completed. Finally, a special commendation for the skill and patience of Ms. Doretta Dodge for her assistance in the tedious task of data tabulation and analysis.

All of these, both mentioned by name and those un-named, have my sincere thanks for all the effort expended over the past three years.

CFA

I. Introduction

In the school year 1971-72 the Erie County Board of Cooperative Educational Services #1 (BOCES) offered a new criterion referenced curriculum development and evaluation service to local school districts on a pilot basis. This service is called the System for Pupil and Program Evaluation and Development (SPPED) which is a developmental project sponsored by the Bureau of School and Cultural Research of the New York State Education Department. The primary component of the SPPED that was implemented on a pilot basis was the Comprehensive Achievement Monitoring (CAM) evaluation system.

CAM was originally initiated under a grant from the Charles F. Kettering Foundation to Dwight W. Allen at Stanford University in 1967. Primary developers of the system were William P. Gorth and Paul Pinsky. In 1968 the project moved to the University of Massachusetts where it came to fruition. CAM has undergone further refinements in New York State under the direction of Robert O'Reilly, Chief, Bureau of School and Cultural Research.

Comprehensive Achievement Monitoring is a computer supported pupil and program evaluation system based upon a criterion referenced model of evaluation. CAM focuses on students' achievement of specific learning outcomes (behaviorally stated objectives) rather than on global educational outcomes. CAM requires the specification of a complete set of objectives for a course and development of specific criterion referenced test items to measure each objective. Thus, CAM focuses on the actual achievement of specific behavioral objectives rather than relative (or norm-referenced) measures of achievement.

The evaluation design underlying the CAM approach is quite different from the more traditional approach to student and program evaluation. Each course objective is tested frequently throughout the duration of the course (semester or school year).

> At each test administration, performance on objectives not yet taught is pretested, performance on objectives just taught is immediately post-tested, and performance on objectives taught earlier in the course is measured for retention. Parallel test forms, comparable in difficulty and content, are all used at each test administration, but each student receives a particular (test) form only once during the course. Each form typically has an item for each objective. Each item is used on only one test form. The function of a particular item changes in relation to the time at which the objective it is measuring is taught. Testing may take place at regular intervals (e.g., every two weeks) or at the end of certain instructional units.[1]

Due to the frequency of testing, the large amounts of data analyzed, and the numerous types of decision-relevant reports possible, computerized data processing is the only efficient and effective system to employ. Output from CAM Computer programs at each test administration provides the following information:

i. Individual Student Data - a total score for that test and each previous one. A total score on the objectives for which the student has received instruction for that test and each previous one. A correct-incorrect indication for each item on the test coded to the specific course objective it measures.

2. Group Summary Data - for each group or subgroup of students (e.g., class, ability group, grade level, etc.); the percentage correct from all test items on all forms for each objective or groupings of objectives such as modules or units.

3. Item Analysis Data - periodically as desired, but usually at the end of a course, data on each item is provided. The information treats each item by its three functions, pretest, posttest, retention and provides data on its difficulty level and the distribution of choices for multiple choice distractors.

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[1] Gorth, William P. "Comprehensive Achievement Monitoring (CAM): A Project to Develop Longitudinal Classroom Evaluation Using Item Sampling." Paper presented at National Council of Measurement of Education. New York, February, 1971, p. 7.

Comprehensive Achievement Monitoring, then, is a systematic way of measuring student achievement of specific learning outcomes employing a longitudinal testing design and the use of computer programs for rapid data analysis and reporting of the results to students, teachers and others. In addition to providing specific information on individual students, the summary data is useful for program evaluation.[2]

II. Research Problem

During the first year in which the BOCES offered the CAM evaluation component of SPPED to a few selected school districts, one of the pilot districts, West Seneca, agreed to conduct a research study cooperatively with the BOCES. Both the local school district and the BOCES Instructional Services staff were interested in determining the impact this technological innovation would have upon the school program and student achievement. The local school district personnel were primarily concerned with whether or not the utilization of CAM would improve student achievement. Both the pilot district and BOCES were hopeful that student achievement in reading would be positively affected by employing this computer based evaluation system. The basic premise underlying the employment of the CAM system was that the receipt of CAM test results on a regular basis would provide students and teachers with relevant data at appropriate times that would increase the effectiveness of the teaching-learning process. The BOCES researcher was also interested in CAM's impact upon student achievement but also wished to answer the question, "Which form of program evaluation, Norm-referenced (NRT) or Criterion-referenced,(CRT), is a more sensitive measure of student learning outcomes?".

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[2] For a more detailed explanation of the CAM system see: Gorth, William, O'Reilly, Robert and Pinsky, Paul, Comprehensive Achievement Monitoring. Amherst, Massachusetts; University of Massachusetts, 1974.

The pilot school district and the BOCES researcher agreed that the proposed study would address itself to both concerns.

Evaluation specialists as well as public school personnel have been examining and debating the CRT vs NRT question for a number of years.[3] The general contention of adherents of CRT is that since "A criterion-referenced test is one that is deliberately constructed to yield measurements that are directly interpretable in terms of specified performance standards",[4] they are more appropriate measures of the intended outcomes of an instructional program. The use of CAM criterion referenced tests as well as a standardized norm referenced measure to assess program outcomes in the pilot school district provided an opportunity to investigate this contention.

Thus, there were two basic propositions under investigation:

1. The use of the CAM evaluation system will significantly increase student achievement.
2. Criterion referenced measures used in the CAM system are more sensitive in detecting instructional program outcomes than standardized norm-referenced measures.

Reformulated into research hypothesis:

H_1: There is no significant difference in the increase in student achievement between those students involved in a program using the CAM system than those students not using a CAM system.

H_2: There is no significant difference in the achievement levels of students as measured by either criterion referenced tests (CAM) or standardized norm referenced tests (Metropolitan Achievement Test).

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[3] See Cronlack, L.J. "Course Improvement Through Evaluation" Teachers College Record, 1963, 43, 672-683 and
Barnabei, Raymond and Leles, Sam. Behavioral Objectives in Curriculum and Evaluation. Dufuque: Kendall/Hunt Publishing Company.
Ross, Paul C. "Some Considerations in the Design and Use of Criterion-Referenced Tests". Paper presented at Northeast Educational Research Association, March, 1970.

[4] Robert Glazer and Anthony J. Nitko, "Measurement in Learning", in Educational Measurement, edited by Robert L. Thorndike, Washington, D.C. American Council on Education, 1971, p. 653.

III. Research Design and Methodology

In conducting research studies in Education the operational circumstances of public schools often preclude the establishment of rigorous research designs prior to undertaking a specific investigation. Such was the case in this study. Though the local school district, West Seneca, was quite cooperative throughout the entire study, much of the data for the study was based upon that which was available via normal school operations. Also, much of the design could be considered post hoc formulation since the specification of the design evolved over the three year period of the study.

At the commencement of the study, approximately December of 1971, the West Seneca Central School District had been utilizing the CAM evaluation system in the intermediate reading program (grades 4-6) in one elementary school building since the beginning of the 1971-72 school year. During the previous summer five teachers from the school district attended a four week workshop where they developed the instructional objectives and criterion referenced test items for their reading program. Therefore, the program had been in operation for a few months prior to the decision to conduct the study.

The initial research design of the study was an "experimental-control" design employing pre and post assessment of student achievement in reading. The school district selected two elementary schools, the Northwood and Clinton Elementary Schools, to serve as the sample populations for the study. Both schools serve a student population residing in the same geographical area. The district was of the opinion that the background of the students, in terms of socio-economic status, wealth, ethnic origins, etc. was very similar for both school-populations. The Northwood School which was using the CAM system was the experimental group and the Clinton School was the control group.

In this first year of the study (the extension of the study into a three year longitudinal design was determined after the results were reviewed at the end of year one) two groups of students in each school were selected as the subjects for the study. All the fourth and sixth grade students receiving regular instruction in reading were chosen to provide the following sample populations:

	Experimental (Northwood)	Control (Clinton)	Total Students
4TH Grade	154	139	293
6TH Grade	131	89	210

Since the effect of CAM on student achievement in the reading program was the major variable under study, controls for as many other variables as possible were attempted. The characteristics of the teachers in both schools (age, experience and training) were examined. The teaching populations in both schools in terms of these variables were very similar. The curriculum and instructional resources (basal readers) were the same for both schools. The policy on student grouping for instruction was the same for both schools. The only major difference between the two groups was that some of the teachers in the experimental group received four weeks of training during a summer workshop on establishing and utilizing a CAM evaluation system.

Probably the most important variable for which controls were needed was the achievement level in reading of both student groups at the beginning of the school term. Shortly after the beginning of the 1971-72 school year, the standardized Metropolitan Achievement Tests (MAT) were administered to both groups of students. The results of the reading section of these tests are reported in Tables 1 and 2.

TABLE 1

Comparison of Mean Standard Scores on the Pre-MAT - Grade 4

	Experimental Group	Control Group
Mean Standard Score	65.9	63.0
Standard Deviation	11.6	13.1
Sample Population Size	156	152

TABLE 2

Comparison of Mean Standard Scores on the Pre-MAT - Grade 6

	Experimental Group	Control Group
Mean Standard Score	83.4	84.3
Standard Deviation	16.1	12.7
Sample Population Size	133	98

The experimental group at the fourth grade level has a statistically significant higher mean score on the pre-test than the control group. The calculated statistic was 2.0567 which was significant at the $P < .05$ level of error. At the sixth grade level the reading ability of the students, as measured by the MAT, was almost the same, there being only .9 difference in the mean standard scores of the two groups. A T test indicated no significant difference. Thus, the sixth graders in the two groups began the school year at approximately the same achievement level, but the fourth graders in the experimental group began the year with a higher achievement level than the control group. Since the school year was well underway when the research study began, it was not possible to obtain pre instruction measures with the CAM tests for the control group.

Teachers from the experimental group developed a set of reading objectives during a summer training session. In addition to a set of instructional objectives for both fourth and sixth grade reading courses the teachers also developed a set of criterion referenced test items to measure the objectives. At the beginning of the school year the fourth and sixth grade teachers from the control group were presented with the set of reading objectives and were asked to indicate which objectives they planned to utilize in their reading program. In all cases, the teachers of the control group indicated that over 95% of the objectives were ones that they attempt to teach toward in their program. Thus, both the experimental and control groups were similar (with the exception of higher achievement level at the 4th grade by the experimental group) and both were being taught the same basic reading program with the same instructional resources. The major difference between the two groups was the utilization of a CAM evaluation system by the experimental group. Eight times a year the experimental student groups were given CAM criterion referenced tests and the students and their teachers received analysis reports on the results.

The final (eighth) CAM test was administered at the end of the school year to both the experimental and control groups of students. The scores on these tests were used as the post instruction criterion referenced measure of student achievement in reading, as were the scores on the norm referenced standardized Metropolitan Achievement Tests in Reading which were also administered in June of 1972. Mean scores for both tests for each group were computed and tests were employed to determine if there were any significant differences in student achievement.

After a review of the first year findings by the school district administration and the BOCES researcher, it was decided that the study should be continued for at least another year.

Due to organizational arrangements and the procedure for the assignment of students to classes, all of the students who participated in the first year of the project were not involved in the second year. The sixth grade students in year one were dispersed into middle school programs which were not using CAM, thus it was impossible to follow their progress in the second year. The fifth grade population in both the experimental (CAM) and control groups (fourth graders the previous year) were the populations under study in the second year. Table 3 depicts the populations involved in this study.

TABLE 3

	Experimental (Northwood)	Control (Clinton)	Total Students
5th Grade	145	129	274

As in the first year, two measurement approaches were utilized to assess student achievement in reading. The criterion referenced CAM tests developed by the 5th grade teachers of the experimental group and the norm referenced Metropolitan Achievement Test (MAT) in reading were administered to both student groups during the first week in June, 1973. The second year design employed only post tests. The fifth grade reading program employed the same basic CAM evaluation design as had the 4th and 6th grade programs the previous year. There were eight criterion referenced tests administered to the experimental group at regular intervals throughout the year. These CAM tests had been revised, based upon item analysis data provided during the first year of the project. It was the result of the item revision process that gave rise to the second hypothesis under investigation in this study. The teachers of the experimental group having had a year's experience working with the criterion measures, were able to refine the criterion test items to more accurately assess student achievement of the program objectives. This assumption along with the inconclusive results in year one led the researcher to believe that the criterion measures would become more sensitive to the effects of a program over time.

In the third year of the study the same basic experimental-control design was used. However, the data collection was expanded to involve as many students as possible and to assess background information on both populations of students. The same two schools remained K-5 buildings as in year two and both the entire fourth and fifth grade students in both schools were chosen as the sample population. The fifth grade students in the experimental group were involved in the CAM program the previous year. Table 4 depicts the populations involved.

TABLE 4

CAM Study Populations - Year 3

	Experimental (Northwood)	Control (Clinton)	Total
4th Grade	134	157	291
5th Grade	141	141	282
			573

To empirically validate the assumption that the family background of both populations of students were similar, a questionnaire was sent to the parents of each fourth and fifth grade student enrolled in both schools. (See Appendix C for copy of questionnaire). Five hundred and ninety-two questionnaires were mailed with four hundred and sixty-seven returned for a return percentage of 78%.

Responses to the survey questionnaire are summarized in Tables 5 and 6.

Table 5

Student Background Data - 4th Grade

Question 1: Father's education

Responses	College Degree		Some College		H.S. Graduate		Some High School		8th Grade Graduate		Less Than 8th Grade		No Response	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Experimental N=142	24	17%	19	13%	67	47%	27	19%	2	1%	1	1%	2	1%
Control N=128	15	12%	34	27%	52	41%	20	15%	2	2%	2	2%	3	2%

Key: Fr. = Frequency
% = Percent

Question 2: Mother's education

Responses	Attended College		High School Graduate		Some High School		8th Grade Graduate		Less Than 8th Grade		No Response	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Experimental N=141	25	18%	84	60%	23	16%	4	3%	1	1%	4	3%
Control N=127	25	20%	81	64%	15	12%	4	3%	1	1%	1	1%

Key: Freq. = Frequency
% = Percent

Question 3: Is mother working?

Response	Yes		No	
	Frequency	%	Frequency	%
Experimental	40	29%	100	71%
Control	41	32%	86	68%

* Percentages are rounded to nearest percent.

Table 5
(Continued)

Question 4: Number of siblings														
Responses	None		One		Two		Three		Four		Five		Over Five	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Experimental N = 142	3	2%	26	18%	59	42%	33	23%	13	9%	6	4%	2	1%
Control N = 127	7	6%	34	27%	36	28%	26	20%	11	9%	10	8%	3	2%

Key: Fr. = Frequency
% = Percent

Question 5: Number of other schools attended												
Responses	No other		One		Two		Three		More than Three		No Response	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Experimental N = 142	61	43%	62	44%	13	9%	2	1%	1	1%	3	2%
Control N = 127	86	68%	32	25%	8	6%	0		0		1	1%

Key: Freq. = Frequency
% = Percent

Question 6: Was student's attitude toward reading changed positively?								
Responses	Yes		No		No Change		No Response	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Experimental N = 141	105	74%	12	9%	23	16%	1	1%
Control N = 127	65	51%	16	13%	44	35%	2	2%

Table 6

Student Background Data - 5th Grade

Question 1: Father's Education														
Responses	College Degree		Some College		H.S. Graduate		Some High School		8th Grade Graduate		Less than 8th Grade		No Response	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Experimental N = 101	16	16%	20	20%	40	40%	18	18%	5	5%	1	1%	1	1%
Control N = 101	20	20%	19	19%	39	39%	16	16%	4	4%	2	2%	1	1%

Key: Fr. = Frequency
% = Percent

Question 2: Mother's Education												
Responses	Attended College		H. School Graduate		Some High School		8th Grade Graduate		Less than 8th Grade		No Response	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	[illegible]
Experimental N = 99	13	13%	62	62%	20	20%	3	3%	0	---	1	1%
Control N = 117	18	17%	60	58%	21	20%	4	4%	0	---	---	---

Key: Freq. = Frequency
% = Percent

Question 3: Is mother working?					
Responses	Yes		No		
	Frequency	Percent	Frequency	Percent	
Experimental N = 98	31	32%	67	68%	
Control N = 101	27	27%	74	79%	

Table 6
(Continued)

Question 4: Number of siblings														
Responses	None		One		Two		Three		Four		Five		Over Five	
	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%	Fr.	%
Experimental N = 105	4	4%	28	27%	40	38%	15	14%	11	10%	7	7%	0	0
Control N = 101	2	2%	19	19%	30	30%	23	23%	20	20%	4	4%	3	3%

Key: Fr. = Frequency
% = Percent

Question 5: Number of other schools attended												
Responses	No other		One		Two		Three		More than Three		No Response	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Experimental N = 99	47	47%	42	42%	9	9%	1	1%	0	0	---	---
Control N = 102	58	57%	34	33%	7	7%	1	1%	1	1%	1	1%

Key: Freq. = Frequency
% = Percent

Question 6: Was student's attitude toward reading changed positively?								
Responses	Yes		No		No Change		No Response	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Experimental N = 99	62	62%	13	13%	23	23%	1	1%
Control N = 102	59	58%	15	15%	27	26%	1	1%

Key: Freq. = Frequency

The family background of the students in both the experimental and control schools was found to be similar. There was a tendency toward slightly smaller families, in terms of the number of children, in the population served by the experimental school (Question 4). The families in the experimental school also are somewhat more mobile than those in the control school population as evidenced by the number of other schools attended (Question 5). Responses to question 6 will be discussed in Section V.

The same achievement measures were utilized in the third year as in the previous years, both the CAM tests and the MAT. Again the CAM tests had undergone another revision prior to the start of the school year. The same teachers as in previous years were responsible for the revisions based upon item analysis data received at the end of the school year (June 1973). In this year of the study all students were pre and post tested with both the appropriate level CAM and Metropolitan Achievement Tests. Thus, student achievement gains in reading were determined as measured by both normative and criterion referenced tests.

From the experience of the first two years of utilizing the CAM system, the teachers in the Northwood School (Experimental Group) determined that one set of objectives and criterion measures was insufficient for all students at any one grade level. During the second year of implementation two sets of objectives and criterion measures were developed for both the fourth and fifth grade reading programs. In effect there were four CAM courses covering the two year span from beginning fourth grade to advanced fifth grade. Thus a more continuous progress curriculum was established. This enabled the students to progress from one set of objectives (course) to another at their individaul learning rates.

In the third year of the study, there were a number of students instructed at both fourth grade levels. At the fifth grade level only one of the two levels of objectives was used for instruction. Thus, three sets of CAM criterion referenced tests were administered to the fourth and fifth grade in both schools on a pre and post basis.

IV. Data Analysis

For each of the three years in which achievement data were collected for both experimental and control groups of students mean scores on each of the four group measures were calculated. T tests were employed to determine statistical significance of differences between these mean scores. Tables displaying the results of the data analysis are contained in Appendix A. In addition, charts depicting criterion referenced score distributions of sub populations of students are found in Appendix B.

Comparisons of reading achievement between the experimental and control groups of students in the first year produced mixed, inclusive results. As was indicated earlier, the 4th grade students in the experimental group in year one had a statistically higher pre-instruction score on the MAT than the control group while there was no statistically significant difference between the two 6th grade groups. Thus, the 4th graders in the experimental group started out with a higher achievement level than the control group.

The results of the Metropolitan Achievement Tests (MAT) in reading which were administered to students in the experimental and control schools at the end of the year were similar to the pre-instruction results. The mean standard score for the fourth grade experimental group was found to be significantly higher than the control group when a T test of significance was employed. The T statistic was calculated as 2.0819 which was significant at the $P < .05$ level of error. Though no statistical test of significance was employed, the grade equivalency score for the experimental group was three and a half months higher than the control group. Though the control group had a mean standard score two points higher than the experimental group at the sixth grade level, it was not found to be statistically significantly higher. The T statistic computed has a value of -1.0526 which was not significant at any acceptable level of error. The control group had a slightly higher mean grade equivalent score than the experimental group.

The results of post-instruction CAM testing in year one indicated the same pattern as the MAT results. The CAM tests at the fourth grade level measured twenty-one different reading objectives with twenty-one different test items. The experimental group of fourth graders had a mean score of 16.41 items correct; whereas, the control group had a mean score of 13.31 items correct. A T test for statistical significance was employed producing a value of 7.56, indicating a significantly higher mean score for the experimental group at the $P < .01$ level of error. The sixth grade CAM tests consisted of seventeen items on each form measuring all seventeen reading course objectives. The experimental group had a mean score of 10.75. The T statistic computed resulted in a value of .223 which indicated there was no statistically significant difference between the mean scores at the sixth grade.

Further data analysis of the CAM test showed marked differences between the fourth grade experimental and control groups, when teacher sub-sections of each course were examined. The results are presented in Table 7.

TABLE 7

Mean Scores of Teacher Sub-Sections for CAM Tests - Grade 4

	Experimental Group	Control Group
Sub-section 1	13.96	12.15
Sub-section 2	14.12	12.86
Sub-section 3	16.73	13.37
Sub-section 4	17.10	13.82
Sub-section 5	19.34	14.23

Three of the class sections in the experimental group had mean scores of the CAM test higher than the highest class section of the control group. In one sub-section (mean score 19.34) ten students had a perfect score. Graphs of all student scores on the CAM test can be found in Appendix B.

Consistent with the overall comparison at the sixth grade level between the experimental and control group using criterion referenced measures is the comparison by class sub-section. The data indicate very little variation between groups.

TABLE 8

Mean Scores of Teacher Sub-sections for CAM Tests - Grade 6

	Experimental Group	Control Group
Sub-section 1	10.07	10.27
Sub-section 2	10.80	10.93
Sub-section 3	10.94	11.07
Sub-section 4	11.41	

In year two only the students who had been 4th graders the previous year (5th graders in year two) were included in the study. Also, only post-instruction measures were administered to both groups (experimental group was pre-tested with the CAM tests).

The CAM tests consisted of thirty-four items measuring 34 separate instructional objectives in reading. The experimental group had a mean score of 25.2 items correct; whereas, the control group has a mean score of 23.1 items correct. A T test for statistical significance was employed producing a T value of 3.0882, indicating a significantly higher mean score for the experimental group at a $P < .01$ level of error.

The results of the MAT in reading indicated a mean standard score of 83.0 for the experimental group and a mean standard score of 80.9 for the control group. The T statistic calculated was 1.4286 which was significant at the $P < .10$ level of error but not at the .05 level.

Although the actual differences in achievement were statistically significant the magnitude of the difference is not exceptionally large, especially the results of the standardized MAT. A score value of 2.1 difference in mean scores between groups for both types of measures was obtained. The variance of student scores on both tests for both groups is also similar. The distribution of scores on the CAM tests are presented in Charts 5 and 6 found in Appendix B. One can observe that student scores for the experimental group are skewed toward the maximum to a slightly greater extent than the scores of the control group students.

This same group of students tested in a similar manner the previous year had approximately the same results. The two year comparison of post-instruction mean scores is contained in Table 9.

TABLE 9

Two Year Comparison of Mean Scores on CAM and MAT

	EXPERIMENTAL GROUP		CONTROL GROUP	
	4th Grade	5th Grade	4th Grade	5th Grade
CAM Score	16.41	25.2	13.31	23.1
MAT Mean Standard Score	65.9	83.0	63.0	80.9
Sample Population Size	128	140	88	129

In year three of the study the curriculum had undergone a major revision. There were now four sets of course objectives and criterion measures for the two grade levels. The design was more rigorously employed in year three with pre and post assessments made to the experimental and control groups at both 4th and 5th grade levels. Three of the four course curricula and sets of CAM measures were used in the third year. Since three different sets of objectives (3 CAM courses) were employed during the year, comparisons between the experimental and control groups were made for all three courses.

A T statistic was computed to test the difference in grade equivalent mean scores on the MAT pre-tests for both fourth and fifth grade students. (Tables A-9 and A-10 Appendix A). The T values for the comparisons between experimental and control groups at the fourth grade level was .000 and at the fifth grade level was -.200, neither of which was statistically significant. Thus, there was no significant difference in reading achievement between experimental and control groups at the beginning of year three as measured by norm referenced tests for either fourth or fifth grade students.

The post-instruction comparisons of achievement measured by the MAT for fourth and fifth grade students are reported in Tables 10 and 11.

TABLE 10

Comparison of Post-test Mean Scores on MAT - Grade 4

	Experimental Group	Control Group
Mean Standard Score	73.21	72.04
Mean Grade Equivalent Score	5.0	4.3
G.E. Standard Deviation	1.6	1.7
Sample Population Size	132	157

TABLE 11

Comparison of Post-test Mean Scores on MAT - Grade 5

	Experimental Group	Control Group
Mean Standard Score	81.24	80.66
Mean Grade Equivalent Score	6.1	6.0
G.E. Standard Deviation	1.9	1.8
Sample Population Size	136	141

The calculation of the T statistic for both fourth and fifth comparisons of G.E. mean scores produced the following respective values, 4th = 3.50 and 5th =.223. At the fourth grade level the T value was statistically significant at the $P < .01$ level of error. Thus the experimental group had a higher reading achievement level as measured by the Metropolitan Achievement Test at the end of the school year, although the mean standard score was only 1.17 points higher. At the fifth grade level there was not a statistically significant difference in the post-test mean grade equivalent scores between the experimental and control group.

The following set of tables, 12, 13, and 14 display the results of the analyses of CAM test data for year three. Again, both pre and post comparisons are made between the experimental and control groups for each of the three CAM courses.

TABLE 12

Comparison of Pre-test and Post-test CAM Mean Scores

Grade 4 - (Course 409)

	Experimental Group	Control Group
Pre-test Mean Score	10.3	10.56
Pre-test Standard Deviation	4.8	3.5
Sample Population Size	40	44
Post-test Mean Score	19.3	10.2
Post-test Standard Deviation	3.7	3.9
Sample Population Size	42	19

The CAM tests for course 409 had 24 test items on each form measuring twenty-four different course objectives. At the beginning of the year, the pre-test mean scores for both groups was almost identical with the experimental group mean score of 10.3 and the control group mean score of 10.56. The T statistics calculated produced a value of -.280 which was not statistically significant. However, the post measure at the end of the year indicated a mean score of 19.3 for the experimental group and 10.2 for the control group. The calculated T value was 8.270 which is statistically significant at the P< .01 level of error. On the average, the students in the experimental group achieved nine more reading objectives during the year than the control group.

TABLE 13

Comparison of Pre-tests and Post-tests CAM Mean Scores - Grade 4 (Course 419)

	Experimental Group	Control Group
Pre-Test Mean Scores	13.0	15.16
Pre-Test Standard Deviation	4.9	4.6
Sample Population Size	115	137
Post-test Mean Scores	20.1	14.7
Post-test Standard Deviation	5.1	4.8
Sample Population Size	125	163

The CAM tests for course 419 had 27 items measuring 27 different course objectives on each of the eight test forms. The pre-test results indicate a mean score of 13.0 correct items for the experimental group and 15.16 items for the control group. The T statistic had a calculated value of -3.600 which was significant at the P< .01 level of error.

At the end of the year the post-test results indicated a mean score of 20.1 correct items for the experimental group and 14.7 items for the control group.

The value of the T statistic was 9.000 which was significant at the P< .01 level of error. Though the experimental group started the school year with a statistically significant lower achievement level in reading than the control group, as measured by the CAM tests, they achieved a significantly higher level of achievement at the end of the year. There was an average gain of over seven objectives by the experimental group while none at all for the control group.

TABLE 14

Comparison of Pre-test and Post-test CAM Mean Scores - Grade 5 (Course 509)

	Experimental Group	Control Group
Pre-test Mean Score	21.6	20.96
Pre-test Standard Deviation	5.4	5.9
Sample Population Size	112	111
Post-test Mean Score	25.6	22.7
Post-test Standard Deviation	5.4	5.6
Sample Population Size	108	114

There were thirty-seven items on the CAM test forms for course 509 measuring 37 different course objectives. The pre-test mean scores were 21.6 for the experimental group and 20.96 for the control group. The T statistic calculated had a value of .850 indicating no statistical difference in the mean scores between the groups. At the end of the school year the post-test mean scores were 25.6 for the experimental group and 22.7 for the control group. Employing a T test to determine whether the difference between mean scores was statistically significant, produced a T value of 3.920. This was statistically significant at the P< .01 level of error. The fifth grade students in the experimental group had gained significantly more than the control group.

The third year data was also analyzed by teacher sub-sections of the courses. Tables A-11, A-12, A-13 in Appendix A display the mean scores by teacher sub-sections for the three experimental groups. This analysis was not possible for the control group since data was not submitted by teacher sub-section.

V. Conclusions and Implications

Three years of data on student achievement in reading were collected and analyzed to provide an emperial base to test the hypotheses under investigation:

H_1: There is no significant difference in the increase in student achievement between those students involved in a program using a CAM system and those students not using a CAM system.

H_2: There is no significant difference in the achievement levels of students as measured by either criterion referenced tests (CAM) or standardized norm referenced tests (Metropolitan Achievement Test).

A clear definitive answer is not readily apparent for the first hypothesis, however, the data support rejection of the second hypothesis. A specific definition of student learning or student achievement is needed to interpret the findings of this study. If student achievement in reading is defined as the successful attainment of the instructional objectives that were developed for each reading course, then the CAM criterion measures are the more appropriate assessment of student learning. However, many educators still prefer to define and assess student achievement in more universal terms; i.e., standardized norm referenced achievement tests.

When employing the definition of student achievement as the successful attainment of the instructional objectives of the course, then the appropriate evidence to consider is the result of the CAM tests. The data indicate that the experimental groups which were provided CAM evaluation information at regular intervals throughout the course did somewhat better in reading achievement than the control groups. If a nationally normed standardized test is the definition of achievement then the results of the Metropolitan Achievement Test in reading is the appropriate criteria to be examined. When the reading achievement of the two groups is compared on the MAT, no clear direction is evidenced from the data. In one case (year 2, fifth grade) the experimental group had a statistically significant higher mean score on the MAT.

in another (year 3, fourth grade) the control group had a higher mean score. In most cases over the three years, however, there was no significant difference between the experimental and control groups on the MAT in reading. Thus, it could be concluded that the use of Comprehensive Achievement Monitoring has no major impact, either positively or negatively upon student achievement as defined by standardized norms.

This finding is not surprising since no attempt was made at the initiation of the project to increase reading scores of students on standardized tests. The intent was to increase student reading achievement in those skill areas defined by a set of instructional objectives developed specifically for the students involved in the West Seneca intermediate reading program. In this effort the CAM system seems successful.

It also can be concluded that the criterion referenced measures used in the CAM system are more sensitive indicators of student achievement than norm referenced tests. If educational decision makers want evaluation data on the effectiveness of their locally developed curricula, they are more likely to detect program strengths and weakness employing criterion referenced measures than standardized norm referenced tests. It should be noted that by the third year of the study the program objectives and criterion test items had been through two revisions. This fact along with the statistically significant differences between the experimental and control groups supports the contention that well developed criterion tests are more appropriate measures of the intended outcomes of an instructional program.

In all post-test comparisons between the student groups using CAM and those not using CAM, with the exception of the year I, sixth grade group, the student achievement of reading skill objectives was significantly higher for those using CAM [5]. The data indicate that the experimental groups which were provided CAM evaluation information at regular intervals throughout the course increased their reading skills to a greater extent than the control groups. The graphs depicting year end scores on CAM tests for both the experimental and control groups are found in Appendix B. In comparing the distribution of student scores it is evident that more students score at the upper ends of the scale in the CAM courses than in the control groups.

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[5] See tables in Section IV "Data Analysis" or in Appendix A for results obtained from the various tests.

In examining class section comparisons (Tables for year one and for year three) it becomes evident that high achievement of course objectives is possible using a CAM system. Though it is possible to improve student achievement, simply installing a CAM evaluation system will not automatically guarantee increased achievement. Some of the sub-section mean scores in both years, one and three, attest to that.

Although the results of the CAM testing indicate significant differences in achievement levels between most of the experimental and control groups, the MAT results given at the same time to the same groups more often than not did not indicate a significant difference. The gain in achievement of the reading skill objectives was detected by the CAM tests while not necessarily by the MAT tests.

Since the higher achievement levels of the experimental groups was evidenced in all three years of the study and the fact that the fifth graders in year two (fourth graders, year one) maintained a higher achievement level after two years in the program, it would appear that the achievement increase is not due to the "Hawthorne Effect" alone. After three years of analyzing results, it appears that the CAM evaluation system does have a positive effect upon student achievement in reading, although the magnitude of the achievement increase is not large. One could conclude that the CAM system has the potential to significantly improve student achievement if utilized to its fullest.

When teachers involved in the experimental situation (designed and used the CAM system) were asked for their impressionistic evaluations and suggestions, one factor was emphasized. Teachers did not have enough time to examine in detail the analysis reports provided by the CAM system. They believed that if they had more time to jointly analyze the CAM test results, they could have greatly improved their instructional decision making. They would have been able to more adequately diagnose both individual and group learning problems and program weaknesses. The analysis of the data by teacher sub-sections supports the contention that when the data is understood and utilized by classroom teachers larger achievement gains result. Thus, the absence of dramatic differences in learning between the experimental and control groups after three years may be due to inadequate use of the analysis information provided by the CAM system. If teachers had spent more time reviewing the test results cooperatively with their colleagues and with the students, the effect upon student achievement may have been greater.

It would also appear that the use of a CAM evaluation system has some positive motivational impact upon students. The results of Question 6, Table 16, indicate a much larger percentage of parents of students in the experimental group believe their children's attitude toward reading has become more positive than those in the control group. A positive attitude toward reading may well have a long range effect upon increased achievement of reading skills.

Probably the clearest implication of the study is the need to replicate it on a much larger basis. Future studies should involve a broader sample of teachers and students and many different subject areas. Related variables such as teacher training, frequency of CAM testing and time allocated to data report analysis ought to be examined. It may be that the potential benefit of a CAM system could be heightened substantially with a small incremental investment in in-service education and periodic released time for teachers.

APPENDIX A

TABLES OF TEST RESULT ANALYSIS

Table A-1

Comparison of Mean Scores on CAM Post tests - Grade 4 (year I)

	Experimental Group	Control Group
Mean Score	16.41	13.31
Standard Deviation	3.50	3.60
Sample Population Size	155	143

Table A-2

Comparison of Mean Scores on CAM Tests - Grade 6 (year I)

	Experimental Group	Control Group
Mean Score	10.84	10.75
Standard Deviation	2.80	2.99
Sample Population Size	128	88

Table A-3

Comparison of Mean Standard Schores on the Post MAT - Grade 4 (year I)

	Experimental Group	Control Group
Mean Standard Score	74	71.2
Standard Deviation	11.62	12.85
Sample Population Size	154	139
Mean Grade Equivalent Score	4.64	4.28

Table A-4

Comparison of Mean Standard Scores on the MAT - Grade 6 (year I)

	Experimental Group	Control Group
Mean Standard Score	85	90
Standard Deviation	13.15	14.07
Sample Population Size	131	88
Mean Grade Equivalent Score	6.8	7.0

Table A-5

Comparison of Gain Scores on the MAT - Grade 4 (year 1)

	Experimental Group	Control Group
Pre Mean Standard Score	65.9	63.0
Post Mean Standard Score	74.0	71.2
Gain Score	8.1	8.2

Table A-6

Comparison of Gain Scores on the MAT - Grade 6 (year 1)

	Experimental Group	Control Group
Pre Mean Standard Score	83.4	84.3
Post Mean Standard Score	88.0	90.0
Gain Score	4.6	5.7

Table A-7

Comparison of Mean Scores on CAM Tests - 5th grade (year 2)

	Experimental Group	Control Group
Mean Scores	25.2	23.1
Standard Deviation	5.1	5.9
Sample Population Size	140	129

Table A-8

Comparison of Mean Scores on MAT - 5th Grade (year 2)

	Experimental Group	Control Group
Mean Standard Score	83.0	80.9
Standard Deviation	12.1	12.0
Sample Population Size	145	128

Table A-9

Comparison of Pre-test Mean Scores on MAT - Grade 4 (year 3)

	Experimental Group	Control Group
Mean Standard Score	63.7	64.0
Mean Grade Equivalent Score	3.7	3.7
G.E. Standard Deviation	1.34	1.6
Sample Population Size	134	139

Table A-10

Comparison of Pre-test Mean Score on MAT - Grade 5 (year 3)

	Experimental Group	Control Group
Mean Standard Score	75.2	75.4
Mean Grade Equivalent Score	5.32	5.36
G.E. Standard Deviation	1.5	1.53
Sample Population Size	141	138

Table A-11

Mean Scores of Teacher Sub-sections for CAM tests - course 409 (year 3)

	Mean Score	Number of Students
Sub-section 1	12.3	4
Sub-section 2	19.8	11
Sub-section 3	20.1	17
Sub-section 4	20.3	10
Total Possible Score	24	

Table A-12

Mean Scores of Teacher Sub-section for CAM Tests - Course 419 (year 3)

	Mean Score	Number of Students
Sub-section 1	9.8	5
Sub-section 2	12.6	8
Sub-section 3	16.3	7
Sub-section 4	17.1	10
Sub-section 5	18.4	10
Sub-section 6	19.2	23
Sub-section 7	21.4	14
Sub-section 8	23.3	16
Sub-section 9	23.9	13
Sub-section 10	25.2	15
Sub-section 11	25.8	4
Total Possible Score	27	

Table A-13

Mean Scores of Teacher Sub-sections for CAM Tests - Course 509 (year 3)

	Mean Score	Number of Students
Sub-section 1	14.6	7
Sub-section 2	19.6	8
Sub-section 3	23.4	16
Sub-section 4	25.3	16
Sub-section 5	25.5	12
Sub-section 6	27.3	18
Sub-section 7	28.2	13
Sub-section 8	30.9	18
Total Possible Score	37	

APPENDIX B

Graphs of Student

CAM Test Scores

CHART 1

4th GRADE EXPERIMENTAL GROUP YEAR 1

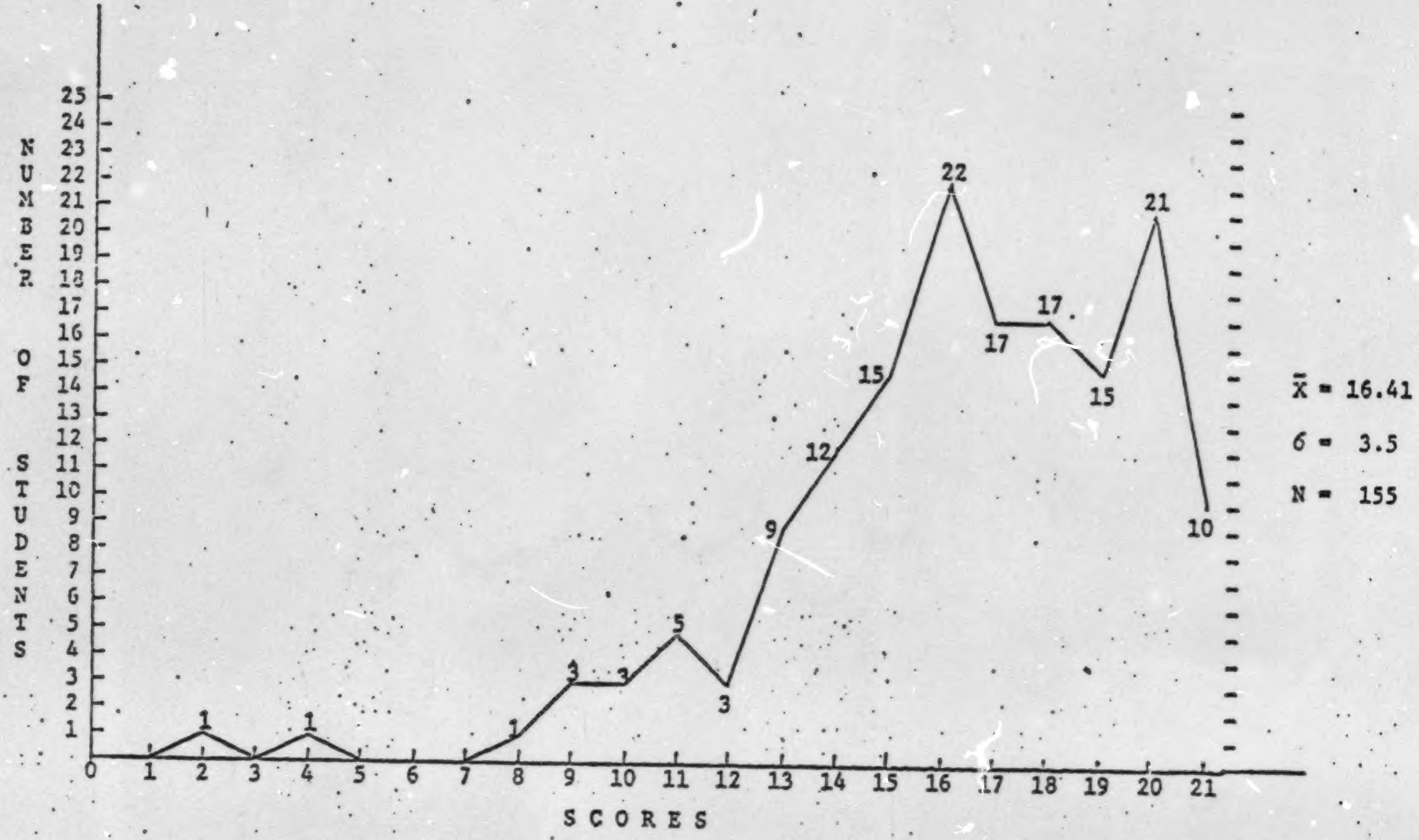


CHART 2

4th GRADE CONTROL GROUP YEAR 1

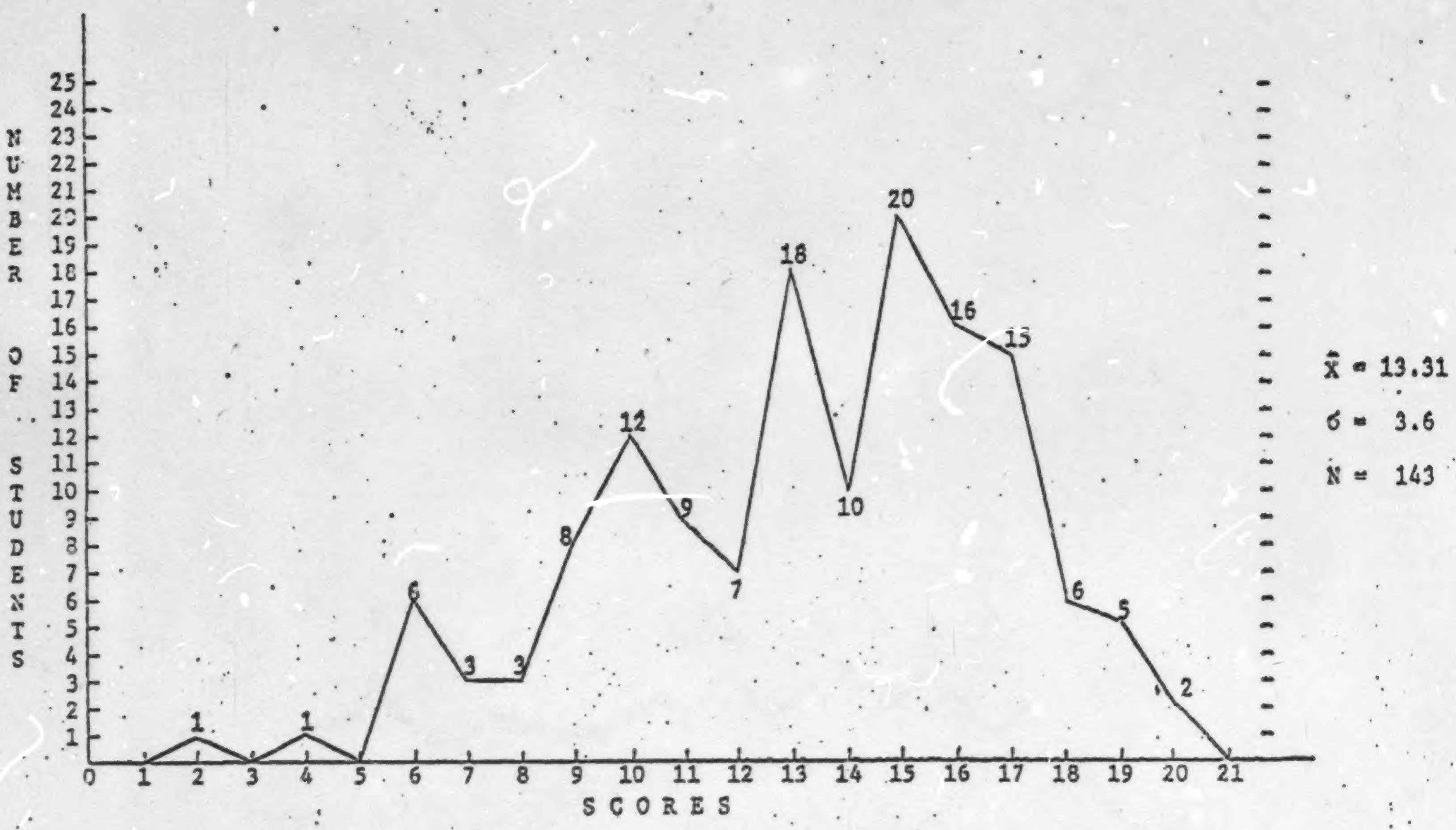
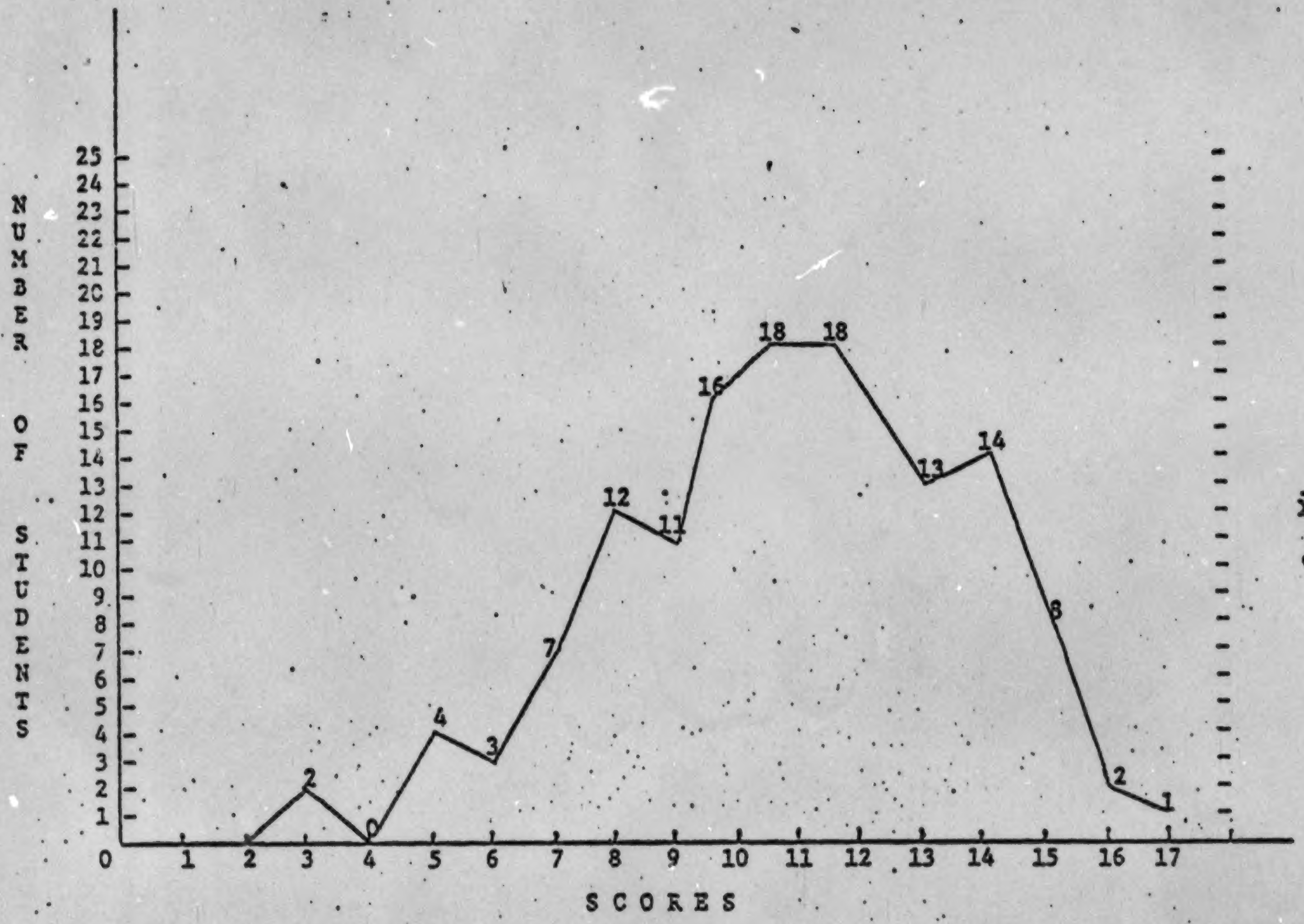


CHART 3

6th GRADE EXPERIMENTAL GROUP YEAR 1

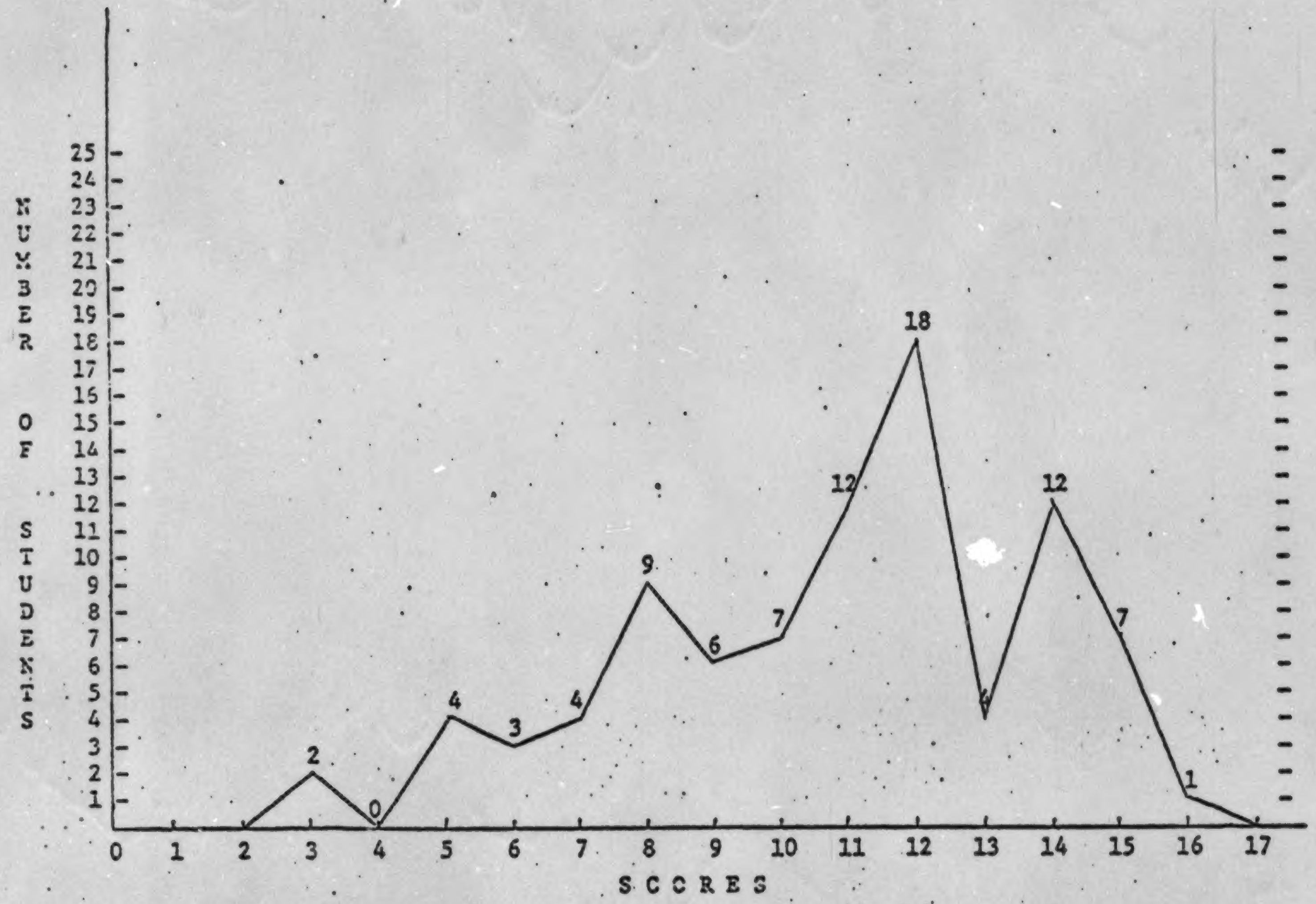


$\bar{X}$ = 10.84

σ = 2.8

CHART 4

6th GRADE CONTROL GROUP YEAR 1



$\bar{X}$ = 10.75

σ = 2.99

CHART 5

5th GRADE EXPERIMENTAL GROUP YEAR 2

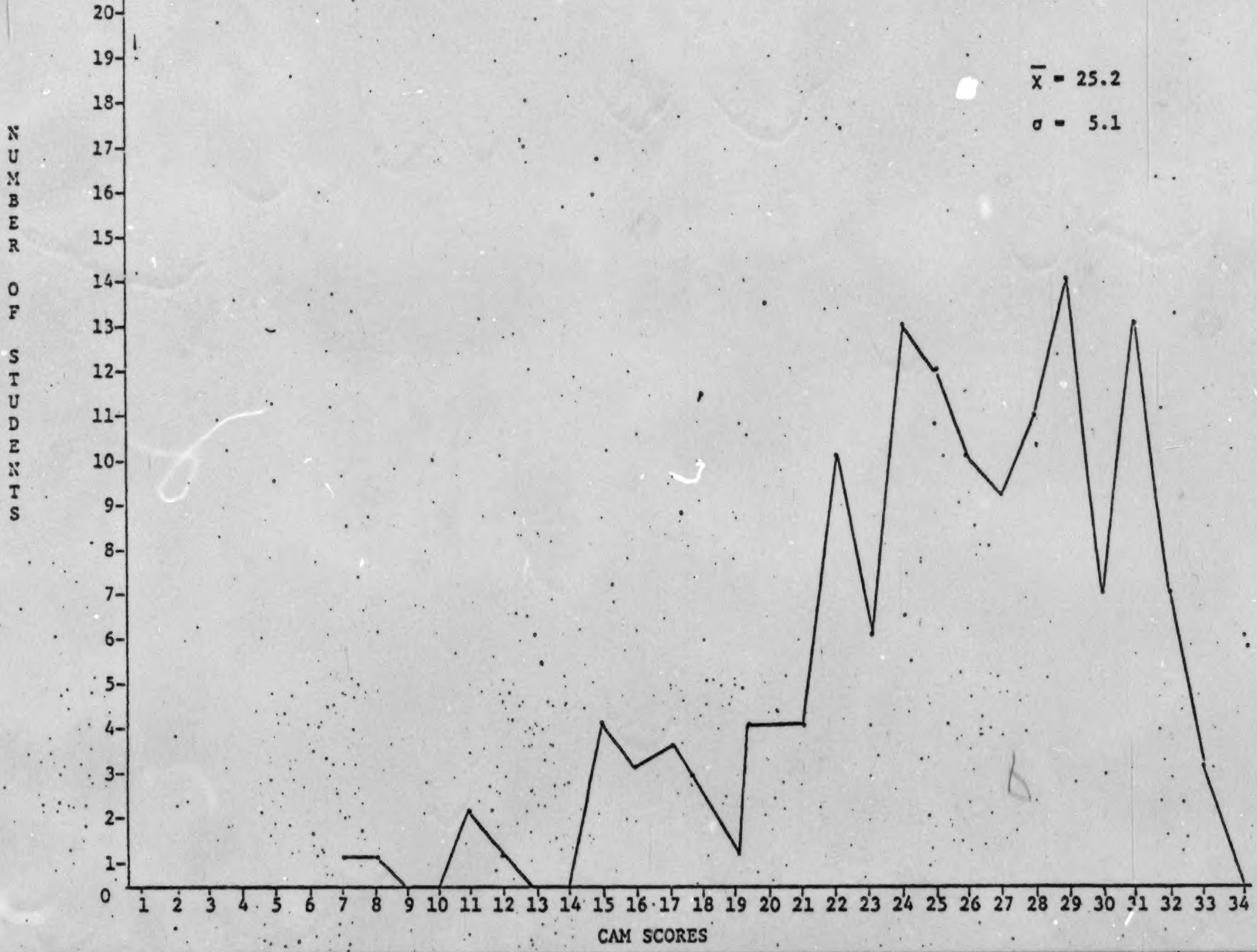
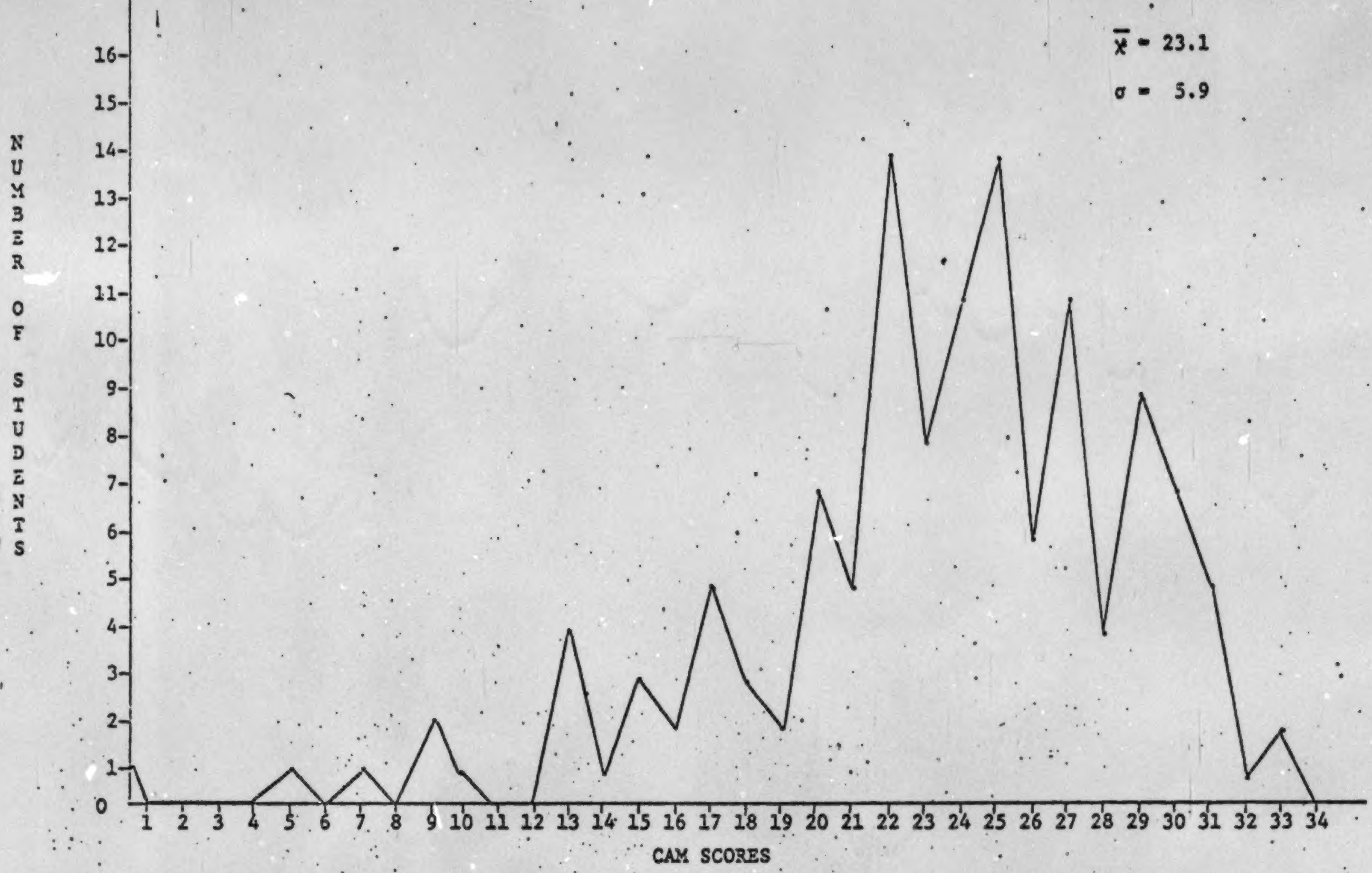


CHART 6

5th GRADE CONTROL GROUP YEAR 2



$\overline{X}$ = 23.1

σ = 5.9

CHART 7

FOURTH GRADE (COURSE 409) EXPERIMENTAL GROUP - YEAR 3

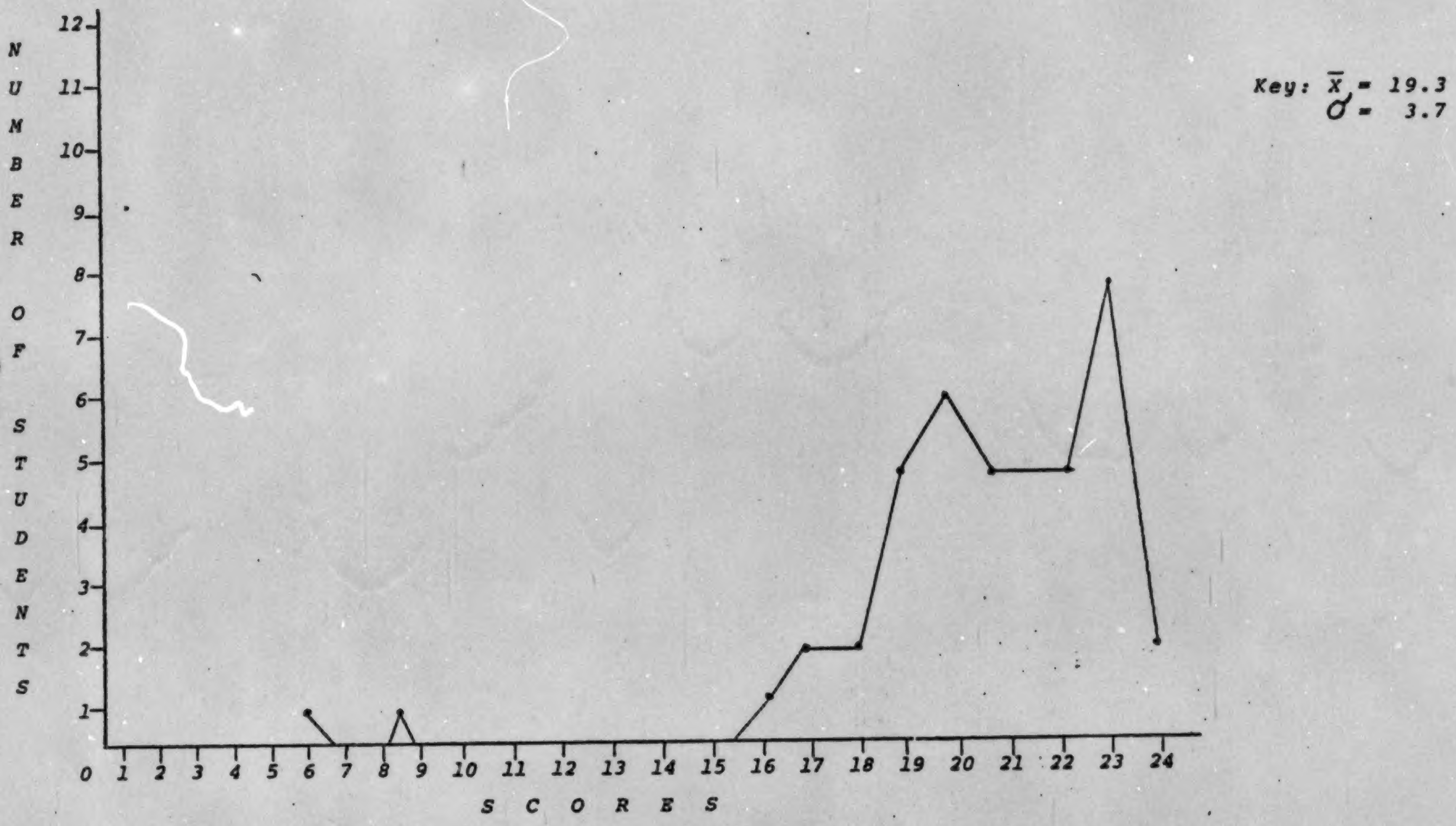


CHART 8

FOURTH GRADE (COURSE 409) CONTROL GROUP - YEAR 3

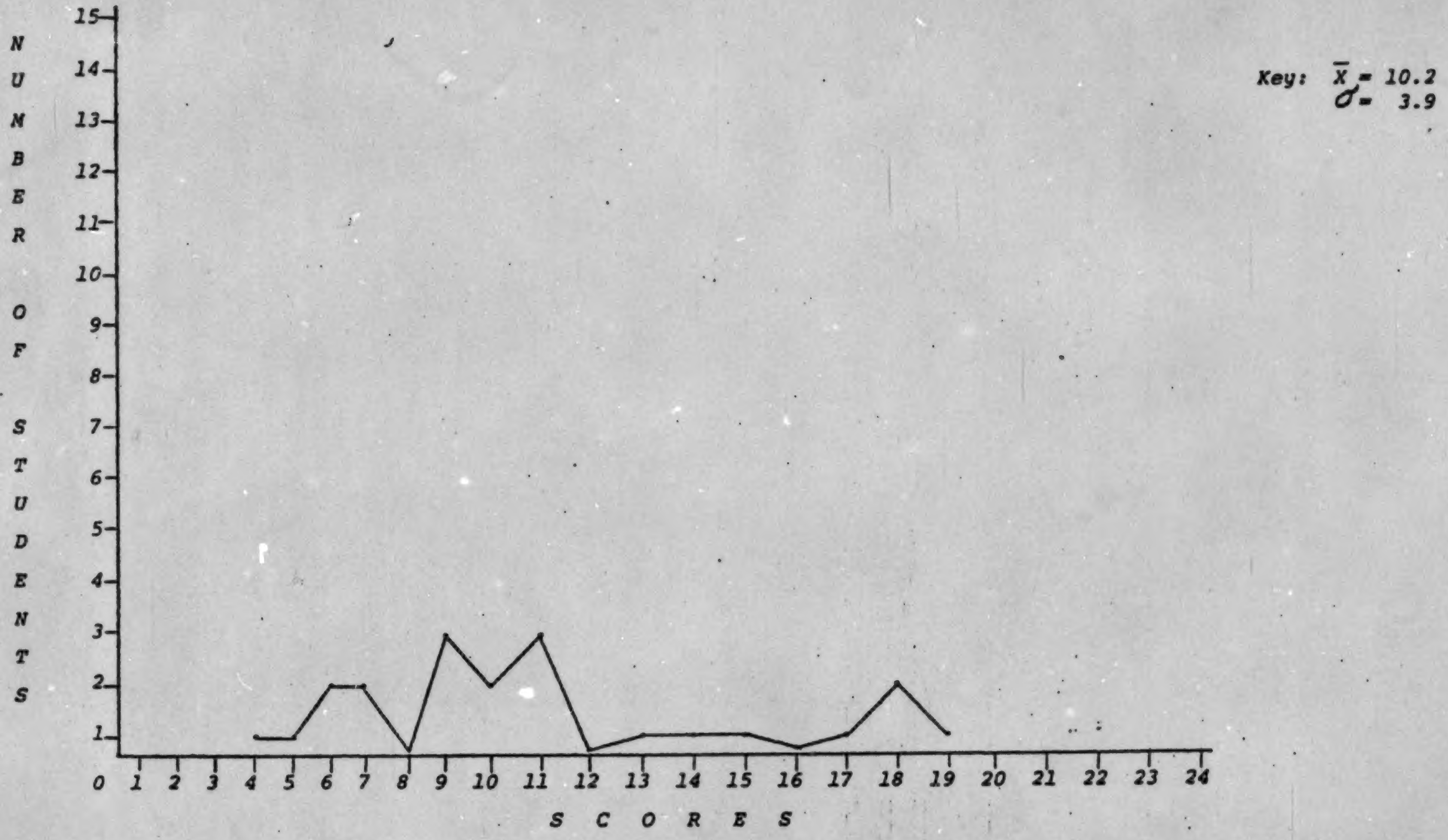


CHART 9

FOURTH GRADE (COURSE 419) EXPERIMENTAL GROUP - YEAR 3

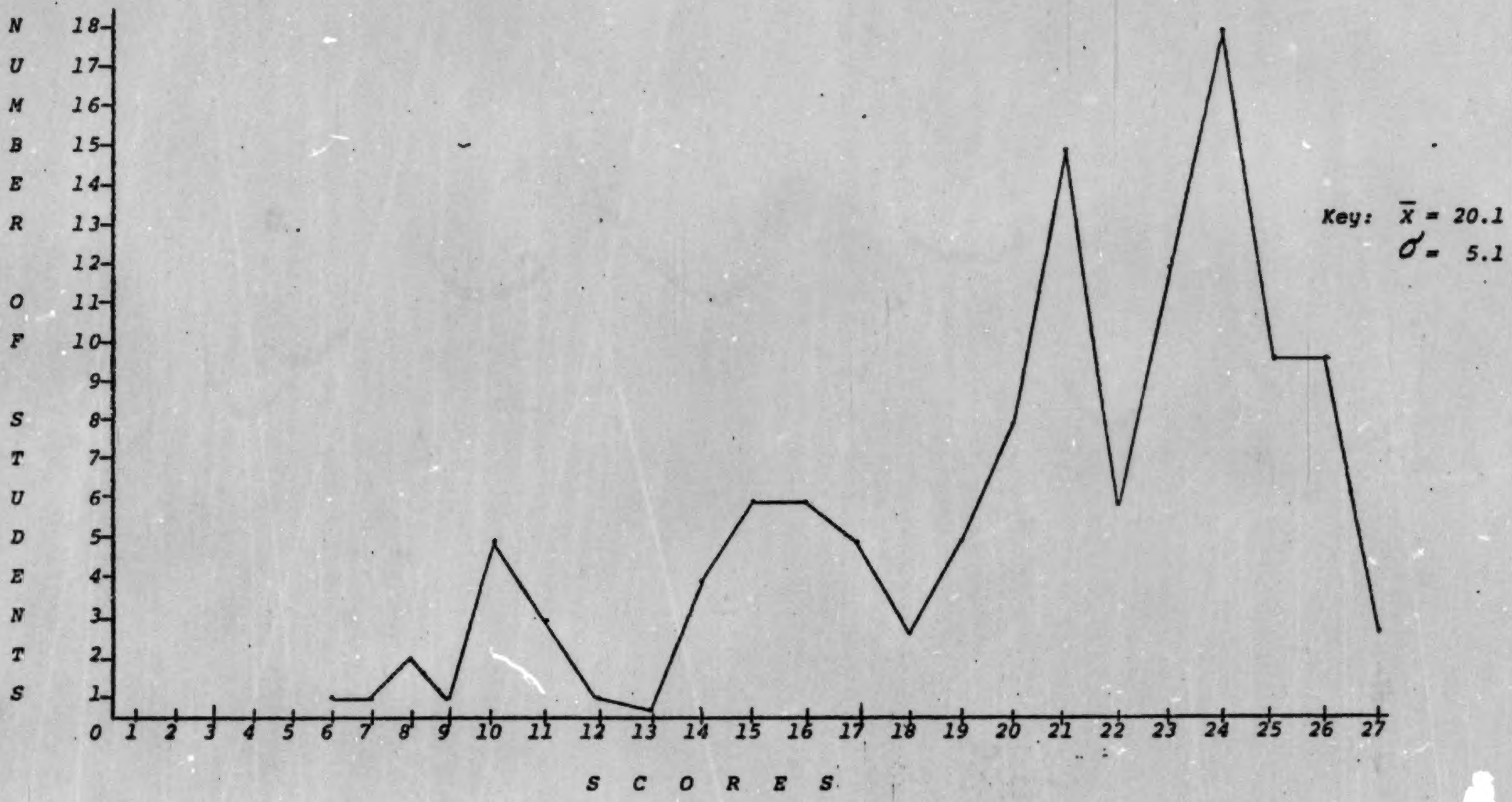


CHART 10

FOURTH GRADE (COURSE 419) CONTROL GROUP - YEAR 3

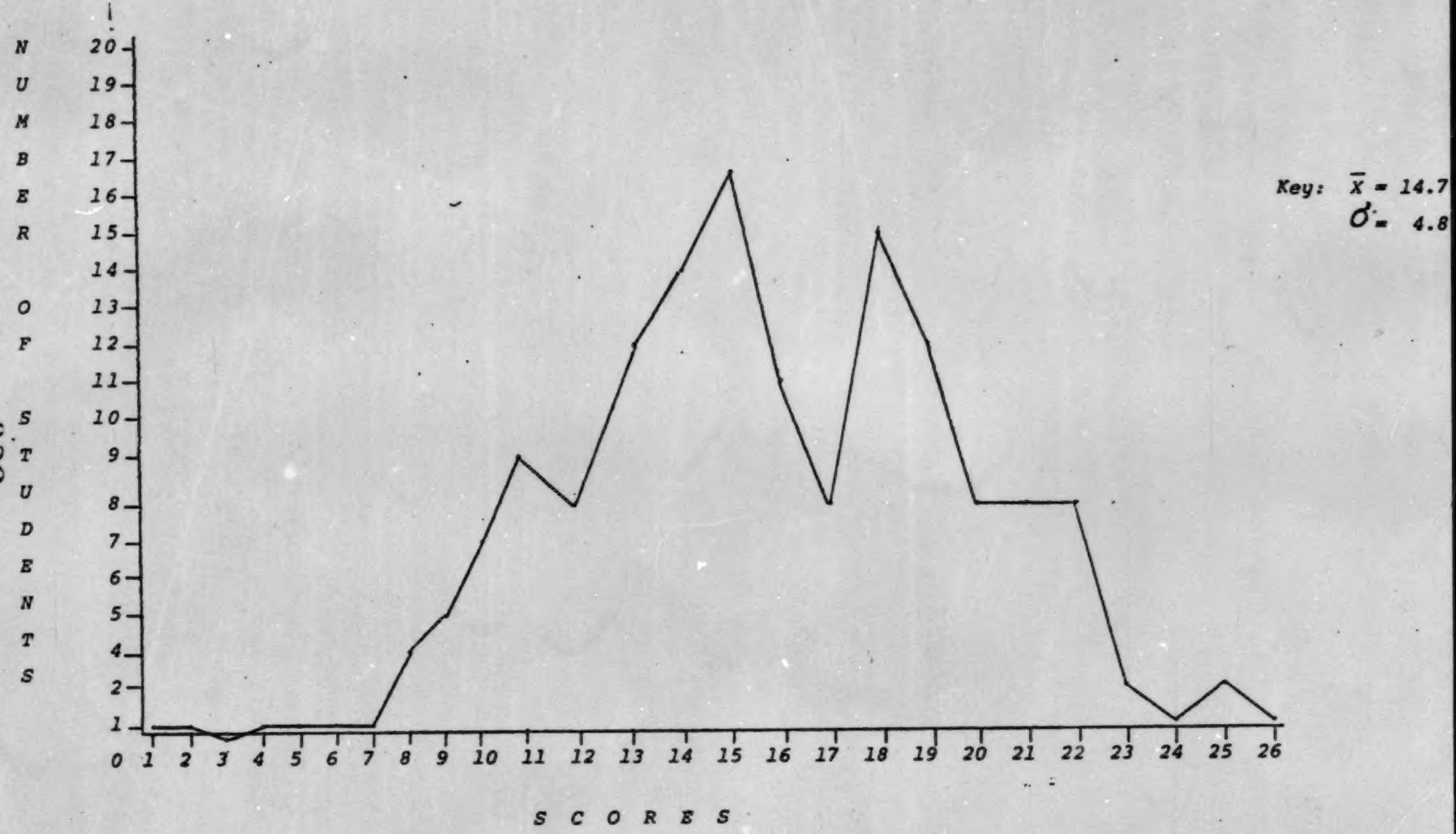


CHART 11

FIFTH GRADE (COURSE 509) EXPERIMENTAL GROUP - YEAR 3

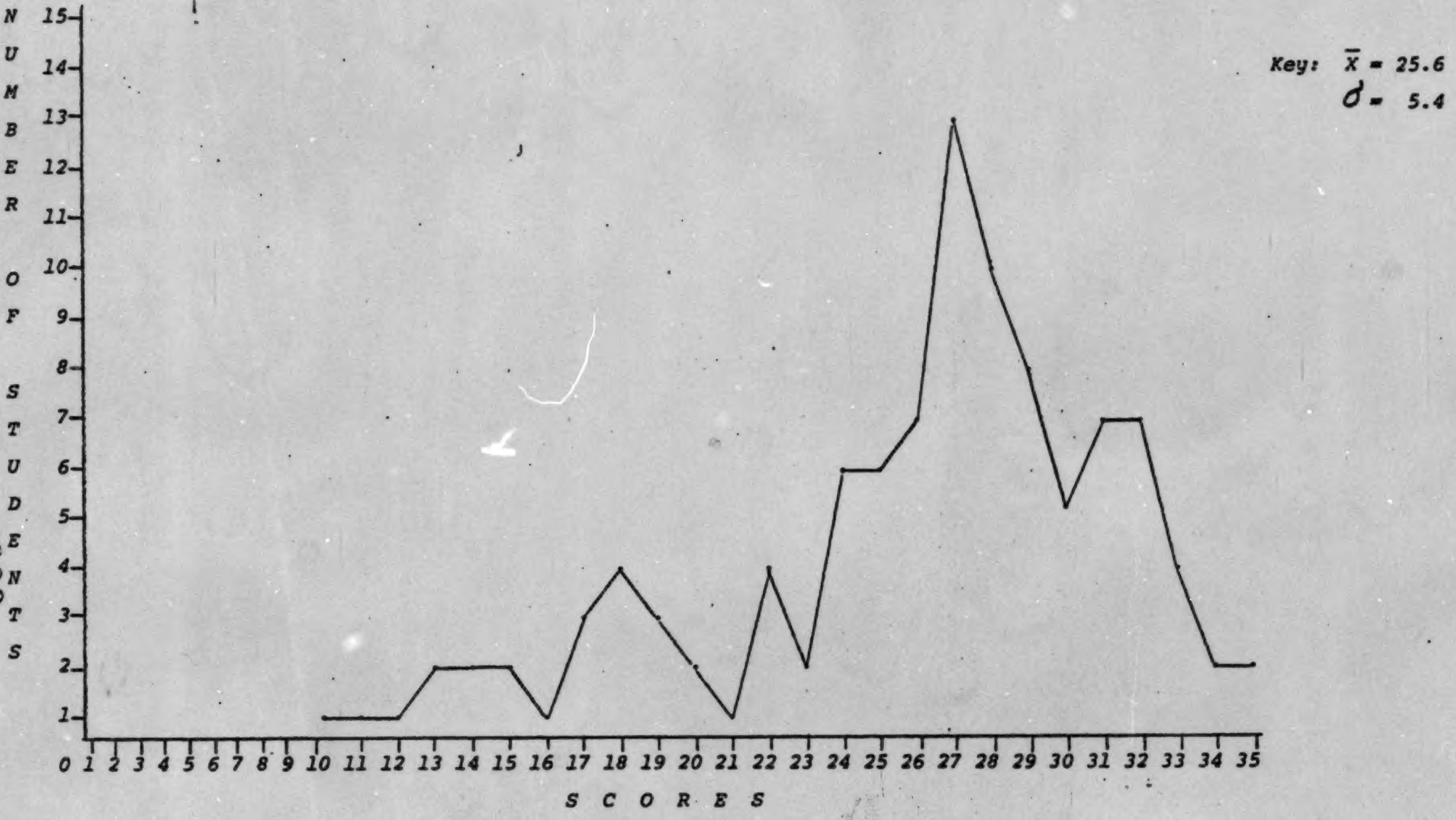
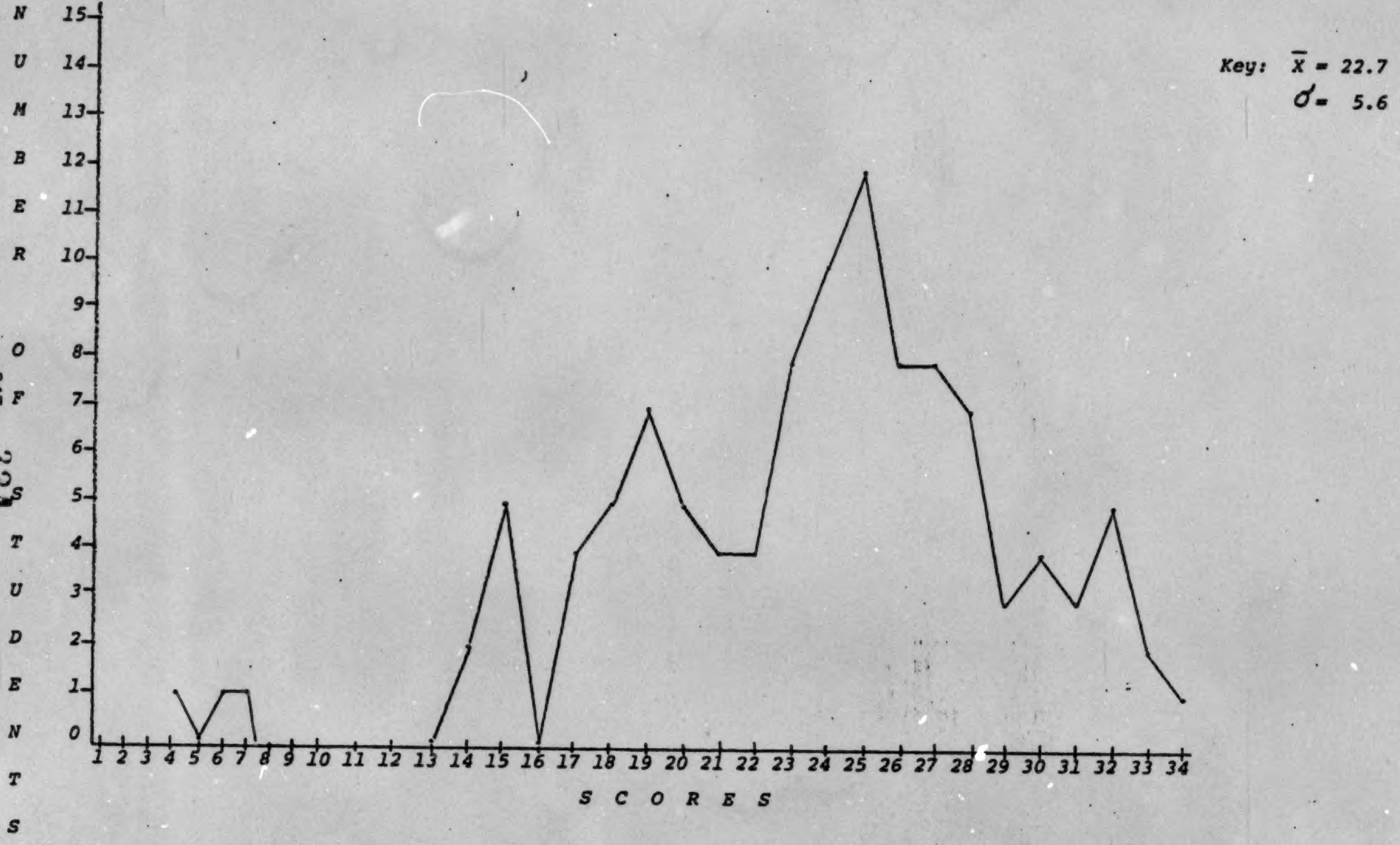


CHART 12

FIFTH GRADE (COURSE 509) CONTROL GROUP - YEAR 3



APPENDIX C

STUDENT BACKGROUND DATA QUESTIONNAIRE

____________________ SCHOOL
____________________ STREET
____________________, NEW YORK

_______________, 1974

Dear Parent:

Please provide information requested on the following form. This information is needed for your child's folder which follows him throughout his schooling.

This information is only for school records and is confidential.

____
Principal

PUPIL'S LAST NAME ____________________ FIRST NAME ____________ MIDDLE ________

BIRTHPLACE ____________________ DATE OF BIRTH ________________ SEX ________

FATHER'S NAME ____________________ BIRTHPLACE ____________________

FATHER'S EDUCATION (a) ATTENDED COLLEGE ☐ Yes ☐ No Degree(s) earned ____________________

(b) GRADUATED FROM HIGH SCHOOL BUT DID NOT ATTEND COLLEGE ____________________

(c) ATTENDED BUT DID NOT GRADUATE FROM HIGH SCHOOL ____________________

(d) FINISHED 8TH GRADE BUT DID NOT ATTEND HIGH SCHOOL ____________________

(e) DID NOT FINISH 8TH GRADE ____________________

MOTHER'S NAME ____________________ BIRTHPLACE ____________________

MOTHER'S EDUCATION (a) ATTENDED COLLEGE ____________________

(b) GRADUATED FROM HIGH SCHOOL BUT DID NOT ATTEND COLLEGE ____________________

(c) ATTENDED BUT DID NOT GRADUATE FROM HIGH SCHOOL ____________________

(d) FINISHED 8TH GRADE BUT DID NOT ATTEND HIGH SCHOOL ____________________

(e) DID NOT FINISH 8TH GRADE ____________________

PUPIL'S PRESENT ADDRESS ____

PHONE ____________________

NOW LIVING WITH ____________________

FATHER'S OCCUPATION, WHERE EMPLOYED ____________________

MOTHER'S OCCUPATION, WHERE EMPLOYED ____________________

NAME OF BROTHERS ____________________ YEAR BORN __________

____________________ YEAR BORN __________

____________________ YEAR BORN __________

NAME OF SISTERS ____________________ YEAR BORN __________

____________________ YEAR BORN __________

____________________ YEAR BORN __________

____

HAS THE PUPIL WHOSE NAME APPEARS ON THE FRONT PAGE ATTENDED SCHOOLS OTHER THAN THE PRESENT ONE ____________________ YES ☐

NO ☐

IF YES, HOW MANY OUTSIDE OF WEST SENECA __________

IN YOUR JUDGEMENT, HAS YOUR CHILD'S ATTITUDE ABOUT READING INSTRUCTION CHANGED POSITIVELY IN THE LAST TWO YEARS?

YES _____

NO _____

NO CHANGE _____

DOES YOUR CHILD MAKE USE OF THE LIBRARY SERVICES MADE AVAILABLE?

Check those which apply

_____ School library

_____ Bookmobile

_____ Public library

IN YOUR JUDGEMENT, HOW WOULD YOU RATE THE CHILD'S GENERAL HEALTH?

_____ Poor

_____ Fair

_____ Good

_____ Excellent

IT IS VERY IMPORTANT THAT YOU RETURN THIS TO YOUR CHILD'S HOMEROOM TEACHER AS SOON AS POSSIBLE.

11.0 Interview Schedules and Response Records

BUILDING PRINCIPAL
INTERVIEW

THE UNIVERSITY OF THE STATE OF NEW YORK
The State Education Department
Bureau of School and Cultural Research
Albany, New York 12224
March 1974

SURVEY OF COMPENSATORY READING PROGRAMS

BUILDING PRINCIPAL INTERVIEW

Directions: This interview is in two parts. The first part is intended to elicit information about your school and the students in it. The second part of the questionnaire has to do with compensatory reading programs. By compensatory reading instruction is meant any reading instruction provided to students because they are reading below their grade level.

PART I

PLEASE PROVIDE THE FOLLOWING INFORMATION ABOUT YOUR SCHOOL. Answer all questions with reference to the current school year unless otherwise indicated.

1. School enrollment this year - all grades. (number of pupils).

2. Number of classrooms.- all grades. (Do not include offices, auditorium, or gymnasium.)

3. If you have a combination of graded and ungraded classes, indicate the instructional organization for each grade, or if ungraded, the equivalent grades in your school.

4. Number of classes and students at each grade level for levels 4-5-6.

5. Percent of total student body that moved from school attendance area last year.

6. Percent of total student body that moved into school attendance area last year.

7. Estimate the percentage (this year) of pupils from families of migrant workers.

7a. Do you feel this is an accurate estimate? Yes, No, or approximate?

8. Estimated percentage of pupils whose families receive public assistance.

8a. Do you feel this is an accurate estimate? Yes, No, or approximate?

9. Estimated percentage of pupils whose head of household attained the following levels of education.

9a. Do you feel these are accurate estimates? Yes, No, or approximate?

10. Estimate the percentage of school families in each of the following occupational categories.

10a. Do you feel these are accurate estimates? Yes, No, or approximate?

11. Estimate the percentage of students of the following racial or national origins.

12. If children are bussed for racial balance, about what percentage of the total student body is bussed in?

13. If children are bussed for racial balance, about what percentage of the total student body is bussed from your school's attendance area to schools in other neighborhoods?

14. Using your best professional judgment, rate each of the following characteristics for your school.

15. Estimate the percentage of students in your school at each of the following grade levels who are reading one or more years below grade level according to current test data. The estimate should be based upon the concept of national norms for the grade for which you are reporting.

16. Are there students in your school who in your judgment are in need of remedial reading instruction but who are not receiving such instruction? Estimate the number or proportion at each grade level.

PART II

READ:

The next part of the interview is intended to elicit information about the compensatory reading program(s) in your school. By compensatory reading instruction is meant any reading instruction provided to students because they are reading below their grade level.

If you have more than one compensatory reading program in operation in your school during this academic year, space is provided is some instances for you to answer questions about each program individually. Some guidelines for determining what constitutes "a program" for purposes of this survey are presented below.

1. If instructional groups (for example, grades) are exposed to materials, personnel, and services, in the regular classrooms that are supplementary to the regular reading program, this should be considered compensatory.

2. If a separate classroom or space is set aside for reading instruction, staffed by special personnel and supplied with special equipment or materials, such an entity should be considered a program.

3. If teachers receive special training for compensatory reading instruction during summers or relaxed time, and that training is funded by supplementary sources, such training, in and of itself, should be considered a program.

17. Describe any special facilities (as staff) in general use among compensatory reading personnel, the classroom teacher, and others involved in the reading program (e.g., media centers, etc.)

18. What was your total (salaries plus materials) school per pupil expenditure last year?

19. What are the total funds allocated for compensatory reading in your school? (Note: this can be completed easily by adding up values provided in all programs in question 20 that follows.)

20. The following are a series of questions concerning the organization and intent of each of your compensatory reading programs. Let's take each program in turn and complete the questions. (TURN TO THE RESPONSE SHEET AND ONE SHEET FOR EACH PROGRAM)

BUILDING PRINCIPAL INTERVIEW: RESPONSE RECORD

Name of Interviewer ______________________________

Date ____________________

Length of Interview ____________

Interviewee Name ______________________________

District ______________________________

Building ______________________________

Grade or Grade Levels Included K 1 2 3 4 5 6 7 8 —

Additional or Adjunct Data to be Collected:

Conditions, dates, or other arrangements for collection:

Remarks:

NOTES

1. Total Enrollment ______________________ 1.

2. Total No. Classrooms ______________________ 2.

3.

	Graded Check	Ungraded Check	Graded & Ungraded Check
gr. 4	☐	☐	☐
gr. 5	☐	☐	☐
gr. 6	☐	☐	☐

3

4.

	No. Classes	No. Students
gr. 4		
gr. 5		
gr. 6		

4.

5. % moved out ☐ % 5.

6. % moved in ☐ % 6.

7. % migrant ☐ % 7.

7a. accurate est.? Yes _______ No._______

Approximate_______

8. % public assistance ☐ % 8.

8a. accurate est.? Yes _______ No._______

Approximate_______

NOTES

9. Educational attainment 9.

Attended college	☐%	☐
Graduated from high school but did not attend college	☐%	☐
Attended but did not graduate from high school	☐%	☐
Finished 8th grade but did not attend high school	☐%	☐
Did not finish 8th grade	☐%	☐

9a Do you feel these are accurate estimates? Yes ______ No ______
Approximate __________

10Occupational level 10.

Unemployed/or welfare	☐%	☐
Unskilled worker (gas station attendant)	☐%	☐
Skilled worker-blue collar (fireman, electrician)	☐%	☐
Skilled worker-white collar (office, sales)	☐%	☐
Business: management or owner level	☐%	☐
Professional (doctor, lawyer, teacher)	☐%	☐

10a. Do you feel these are accurate estimates? Yes ______ No _____
Approximate __________

NOTE

11. Ethnic composition 11

Caucasian or White	☐%	☐
Negro or Black	☐%	☐
Spanish surnamed	☐%	☐
Oriental	☐%	☐
American Indian	☐%	☐
Other (Specify____________)	☐%	☐

12. % Bussed in ☐% 12.

13. % Bussed out ☐% 13.

14.

14. School Characteristics	Highly Adequate	Adequate	Inadequate	Highly Inadequate
Size of physical plant for pupils	☐	☐	☐	☐
Condition of physical plant	☐	☐	☐	☐
Suitability of physical plant for program operation	☐	☐	☐	☐
Is the number of instructional personnel (teachers, specialists)	☐	☐	☐	☐
Is the number of other professional personnel (psychologists, social workers)	☐	☐	☐	☐
Suitability (quality) of books, periodicals, and other printed materials for instruction	☐	☐	☐	☐
Suitability (quality) of audio-visual materials for instruction	☐	☐	☐	☐
Suitability (quality) of instructional equipment for instruction	☐	☐	☐	☐

NOTES

15		Reading Below Grade Level		15.
	grade 4	%		
	grade 5	%		
	grade 6	%		
16.	grade 4	%		16.
	grade 5	%		
	grade 6	%		

17. Special facilities 17

18. Total school expenditure (salaries plus materials) 18

19. Total compensatory expenditure (salaries plus materials) 19

SP

SPECIALIST INTERVIEW

THE UNIVERSITY OF THE STATE OF NEW YORK
The State Education Department
Bureau of School and Cultural Research
Albany, New York 12224
March 1974

1. Numbers of teachers and students serviced by this program?

2. Can you provide us with a time or appointment schedule showing the names of students in classrooms serviced by you in your program at levels 4, 5, and 6? On this schedule, would you circle any student who has not been with you for the year but who has been seen by you over a period of between 10 and 20 weeks. If a student will be seen by your for less than 10 weeks this school year, draw a line through his name. This list will communicate as follows:

Student name (as is):	Student has been (or will be) with you for more than ½ the school year (more than 20 wks)
Student name (circled)	Student has been (or will be) with you regularly for no more than 20 weeks and not less than 10 weeks
Student name (line drawn through)	Student has been (or will be) with you regularly for less than 10 wks)

3. What percentage or number of the pupils in your program (4-5-6) are members of the following racial or national origin group?
   (Point to the response sheet)

4. What is the average or typical absentee rate in your sessions with students in grades 4, 5, and 6?
   (Daily number or percent)

5. What is the % or number of new pupils who will be taken into your program during the school year in grades 4, 5, and 6?

6. What % or number of pupils in grade 4, 5, and 6 will move out of your program during this year?

7. How far do you expect the typical pupil in your reading class will actually go in school under the existing program?
   (Point to the response sheet)

8. If the students in your reading class were given whatever special support or programs they needed throughout their years in school, what is the highest level that the typical pupil would achieve?
   (Special reading programs, cultural enrichment, individualized programs, etc.)

9. During the school year, how many professionals other than yourself have held your particular assignment with your reading classes for at least two consecutive weeks?

10. Do you organize your instruction into groups or is it individual instruction?

10a. Describe the criteria or diagnostic materials used for determining group placement or individual program.

11. How frequently does the composition of your reading groups change because of different rates of learning or different skill deficiencies among students?

12. Describe any unusual or outstanding features of your program at levels 4-5-6.

13. Describe the facilities used in your instruction.

14. Please indicate what materials you use in your reading instruction and to what extent you use them.

15. Indicate any additional materials not on the printed list.

16. Please list any equipment or hardware used in your reading program.
    (Indicate as major or supplementary and the number of hours of use per week)

17. Please list any instructional materials that you create for your reading program, such as charts,
    (Point to the response sheet)
    and whether they are a major or supplementary resource.

17a. What is the per-monthly or annual cost of the self-created reading materials?

18. For the materials that you listed as in regular use in your reading program, what is the length of your use or experience?

19. Briefly describe your formal training in the teaching of reading in terms of types of courses and recency.
    (Point to the response sheet)

20. What types of inservice training in the teaching of reading have you had in the last two years?

21. What is your average amount of preparation time for reading instruction per week?

22. What is the average amount of time spent per week in coordinating activities in your reading program with other professional personnel, such as the classroom teacher?

SP

SPECIALIST INTERVIEW: RESPONSE RECORD

Name of Interviewer ______________________________

Date ______________________________

Length of Interview ______________________________

Interviewee's Name ______________________________

Names of other staff ______________________________

____

District ______________________________

Building ______________________________

Type of teacher ______________________________

Grade or Grade Levels Serviced K 1 2 3 4 5 6 7 8

Title of this Compensatory Program ______________________________

____

Additional or Adjunct Data to be Collected:

Conditions, dates, or other arrangements for collection:

Remarks:

NOTE: Complete one form for each Compensatory Reading Program

NOTES

1.	Grade 4		Grade 5		Grade 6		1.
	Teacher	Student	Teacher	Student	Teacher	Student	

2. Schedule attached? ______ 2.

3.	(a) Caucasian or White	%		3.
	(b) Negro or Black	%		
	(c) Spanish surnamed	%		
	(d) Oriental	%		
	(e) American Indian	%		
	(f) Other__________	%		

3a. Do you feel these are accurate estimates? 3a.
___yes ___no ___approximate

4.	Rate absentee	%		4.
5.	Move into program during year	%		5.
6.	Move out of program during year	%		[illegible]

7. Educational attainment, existing conditions 7.

Eighth grade or lower ☐

Ninth, tenth, or eleventh grade ☐

High school graduate ☐

Junior college, business school, or any other post-secondary training but not a four year college. ☐

Four year college or beyond ☐

Other (Specify)________________________ ☐

8. Educational attainment, ideal conditions 8.

Eighth grade or lower ☐

Ninth, tenth, or eleventh grade ☐

High school graduate ☐

Junior college, business school or any other post-secondary training but not a four year college ☐

Four year college or beyond ☐

Other (Specify)________________________ ☐

9. Teacher absence 9.

____

10. Group or individual instruction 10.

____

____

____

10a. Criteria or diagnostic materials used 10a.

Tests____________________________________

____

____

Other____________________________________

____

____

11. Frequency of change in grouping 11.

____

12. Outstanding features______________________ 12.

____

____

____

____

13. Facilities used________________________ 13.

____

____

____

____

14. Series Titles (Specify)	Major Resource	Supplemental Resource	Series Titles (Specify)	Major Resource	Supplemental Resource
Addison-Wesley	☐	☐	Laidlaw	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Allyn & Bacon	☐	☐	Lippincott	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
American Book Co.	☐	☐	Macmillan	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Benefic	☐	☐	McGraw-Hill	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Follett	☐	☐	Merrill	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Ginn & Co.	☐	☐	Modern Curriculum Press	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Harcourt Brace & World	☐	☐	Open Court	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Harper Row	☐	☐	Random House	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Holt-Rinehart & Winston	☐	☐	Scholastic	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Houghton-Mifflin	☐	☐	Scott Foreman	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
ITA	☐	☐	SRA	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐

15. 15

List all other software including workbooks, magazines, tradebooks, classroom libraries, filmstrips, movies	Used as major resources in teaching reading	Used as supplement
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
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	☐	☐
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	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐
	☐	☐

16. Hardware	Used as a major resource in teaching	Used as a supplement or option	Amount of use/week	16.
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	
____________________	☐	☐	________	

17. Materials Created	Used as a major resource in teaching reading	Used as a supplement	17
Worksheets	☐	☐	
Transparencies for overhead projector	☐	☐	
Slides	☐	☐	
Charts	☐	☐	
Tapes	☐	☐	
Other (Specify) ____________	☐	☐	

17a. Per-monthly or annual school cost for self-created materials ____________ monthly ____________ annual 17a

18. Length of experience with materials ________________________________ 18.

NOTES

19. Formal training: college courses 19

	Within 5 years	Before 5 years
Number of courses	☐	☐
Course Content		
New instructional techniques in reading	☐	☐
Diagnosis of reading problems	☐	☐
Open classroom methods	☐	☐
Individualized instruction	☐	☐
Use of equipment & materials	☐	☐
Techniques for cultural enrichment	☐	☐
Other_______________	☐	☐

20. Inservice training within the last 2 years. 20

	Within 2 years
Number of clock hours per month	☐
Course Content	
New instructional techniques in reading	☐
Diagnosis of reading problems	☐
Open classroom methods	☐
Individualized instruction	☐
Use of equipment & materials	☐
Techniques for cultural enrichment	☐
Other_______________ ____________________	☐

21. Preparation time (minutes per week) 21.

---

22. Coordination with other personnel (minutes per week) 22.

TEACHER INTERVIEW

THE UNIVERSITY OF THE STATE OF NEW YORK
The State Education Department
Bureau of School and Cultural Research
Albany, New York 12223
March 1974

CLASS CHARACTERISTICS

1. How many pupils are in your daily reading class?
   (Have teacher check the class list)

2. What percentage or number of the pupils in your daily reading class have received compensatory reading instruction prior to this year?
   (Programs designed to compensate through time and effort beyond the daily reading program, usually are disadvantaged kids)

3. What percentage or number of the pupils in your reading class attended some form of preschool?
   (Head Start, day care, nursery school) DO NOT INCLUDE PUBLIC SCHOOL KINDERGARTEN.

4. What percentage or number of the pupils in your class are members of the following racial or national origin group?
   (Point to the response sheet)

5. What percentage or number of the students in your class come from homes where the dominant language is not English?

6. If the dominant language is not English, list those spoken.

7. Indicate the percentages or numbers of pupils in your class whose family incomes are derived from each of the following occupational categories.
   (Point to the response sheet)

8. What is the average or typical absentee rate in your class?
   (Daily number or percent)

9. What do you feel is the major cause(s) of absenteeism among your pupils?
   (Ex's: illness or pupil; illness in family, truancy, pupil performs duties at home; expulsion)

10. What is the percentage or number of pupils in your class who will move into your class before the end of the year?

11. What is the percentage or number of pupils in your class who will move out of your class before the end of the year?

12. How far do you expect the typical pupil in your reading class will actually go in school under the existing program?
    (Point to the response sheet)

13. If the students in your reading class were given whatever special support o programs they needed throughout their years in school, what is the highest level that the typical pupil would achieve?
    (Special reading programs, cultural enrichment, individualized programs, etc.)

PROGRAM CHARACTERISTICS

14. If your reading class is organized into groups, describe the criteria used for determining placement of students into groups. (e.g., standardized test scores, skill deficiencies, etc.)
    (Write down the names of the standardized and other tests used.)

15. How frequently does the composition of your reading groups change because of different rates of learning or different skill deficiencies among students?

16. Describe any unusual or outstanding features of your reading program.

17. Please indicate what materials you use in your reading instruction and to what extent you use them.

18. Indicate any additional materials not on the printed list.

19. Please list any equipment or hardware used in your reading program.
    (Indicate as major or supplementary and the number of hours of use per week)

20. Please list any instructional materials that you create for your reading program, such as charts. (Point to the response sheet) and whether they are a major or supplementary resource.

20.a. What is the per-monthly or annual cost of the self-created reading materials?

21. For the materials that you listed as in regular use in your reading program, what is the length of your use or experience?

TEACHER CHARACTERISTICS

22. Briefly describe your formal training in the teaching of reading in terms of types of courses and recency. (Point to the response sheet)

23. What types of inservice training in the teaching of reading have you had in the last two years?

24. What is your average amount of preparation time for reading instruction per week?

25. What is the average amount of time spent per week in coordinating activities in your reading program with other professional personnel (e.g., the reading specialist, team members, psychologist, etc.)

26. During the school year, has anyone other than yourself have held your particular teaching assignment with your reading class for at least two consecutive weeks?
COUNT SUBSTITUTE TEACHERS AND REPLACEMENT TEACHERS: DO NOT COUNT STUDENT TEACHERS OR CLASSROOM AIDES

27. On average how much time does a typical pupil in your class get for free, non-instructional reading activities?

T

TEACHER INTERVIEW: RESPONSE RECORD

Name of Interviewer______________________________

Date____________________

Time Scheduled____________________

Time Started ____________________

Interviewee Name______________________________

District______________________________

Building______________________________

Grade or Grade Levels Included K 1 2 3 4 5 6 7 8 —

Additional or Adjunct Data to be Collected:

Conditions, dates, or other arrangements for collection:

Remarks:

NOTES

1.
2.
3.
4.
5.
6.
7.

1. Number pupils in reading class ☐

2. Received compensatory education ☐ % ☐

3. Preschool attendance ☐ % ☐

4\.

☐ %	☐	Caucasian	☐ %	☐	Blac or Negro
☐ %	☐	Oriental	☐ %	☐	Spani Surna
☐ %	☐	American Indian	☐ %	☐	Other

5. Dominant home language not English ☐ % ☐ 5.

6. Language: ______________________ 6.

7. Head of household — occupation 7.

Umemployed/or welfare	☐ %	☐
Unskilled worker (gas station attendant)	☐ %	☐
Skilled worker - blue collar (fireman, electrician)	☐ %	☐
Skilled worker—white collar (office, sales)	☐ %	☐
Business: management level	☐ %	☐
Professional (doctor, lawyer, teacher, etc.)	☐ %	☐
Don't know	☐ %	☐

NOTES

8.

9.

10.

11.

12.

13.

8. Absentee rate (per day) ☐% ☐ 8.

9. Cause of absence: ____________________ 9.

____

10. Move into classroom since Sept.
☐% ☐ 10.

11. Move out of classroom since Sept.
☐% ☐ 11.

12. Educational attainment, existing conditions 12.

Eighth grade or lower ☐

Ninth, tenth, or eleventh grade ☐

High school graduate ☐

Junior college, business school, or any other post-secondary training but not a four year college ☐

Four year college or beyond ☐

Other (Specify)______________ ☐

13. Educational attainment, ideal conditions 13.

Eighth grade or lower ☐

Ninth, tenth, or eleventh grade ☐

High school graduate ☐

Junior college, business school, or any other post-secondary training but not a four year college ☐

Four year college or beyond ☐

Other (Specify)______________ ☐

NOTES

14.

15.

16.

PROGRAM CHARACTERISTICS

14. Grouping Criteria 14.

Tests ______________________________

____

____

____

____

____

Other ______________________________

____

____

____

____

____

15. Group composition change: frequency 15.

____

16. Outstanding features of reading program 16.

____

____

____

____

____

____

____

____

____

____

17.

Series Titles (Specify)	Major Resource	Supplemental Resource	Series Titles (Specify)	Major Resource	Supplemental Resource
Addison-Wesley	☐	☐	Laidlaw	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Allyn & Bacon	☐	☐	Lippincott	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
American Book Co.	☐	☐	Macmillan	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Benefic	☐	☐	McGraw-Hill	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Follett	☐	☐	Merrill	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Ginn & Co.	☐	☐	Modern Curriculum Press	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Harcourt Brace & World	☐	☐	Open Court	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Harper Row	☐	☐	Random House	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Holt-Rinehart & Winston	☐	☐	Scholastic	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
Houghton-Mifflin	☐	☐	Scott Foresman	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
ITA	☐	☐	SRA	☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐
	☐	☐		☐	☐

18. All other software including workbooks, magazines, tradebooks, classroom libraries, filmstrips, movies

	Maj. Res.	Sup. Res.
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐
________________	☐	☐

19. Hardware	Maj. Res.	Sup. Res.	Amount of use/week
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
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________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________
________________	☐	☐	____________

1

20. Materials created:	Major	Supplement
Worksheets	☐	☐
Transparencies	☐	☐
Slides	☐	☐
Charts	☐	☐
Tapes	☐	☐
Other ________________	☐	☐

20

20.a. School cost of self created materials Per Month ____________ 20.

Per Year ____________

21. Experience with major resource materials ________________________ 21

NOTES

22.

23.

22. Formal training: college courses

	Within 5 years	Before 5 year
Number of courses	☐	☐
Course Content		
New instructional techniques in reading	☐	☐
Diagnosis of reading problems	☐	☐
Open classroom methods	☐	☐
Individualized instruction	☐	☐
Use of equipment & materials	☐	☐
Techniques for cultural enrichment	☐	☐
Other ____________________	☐	☐
____________________		

23. Inservice training within the last 2 years.

	Within 2 years
Number of clock hours per month	☐
Course Content	
New instructional techniques in reading	☐
Diagnosis of reading problems	☐
Open classroom methods	☐
Individualized instruction	☐
Use of equipment & materials	☐
Techniques for cultural enrichment	☐
Other ____________________	☐
____________________	

NOTES

24.

25.

26.

27.

24. Preparation for reading: min./week ______

______

25. Coordination of reading instruction with other professionals: min./week ______

______

26. Teacher absence ______

27. Noninstructional reading activities: min./week ______

ALLOCATION OF STUDENTS TO PROGRAM

Teacher Name:

Student Number		Student Name		Program Number (Minutes per week)					

CHARACTERIZATION OF PROGRAM

Director ____________

Program Name ____________

Location ____________

1.1 Whole Class	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

1.2 Small Group	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

1.3 Individual	Inst.	Sup
Teacher ☐☐☐☐	___%	___
Specialist ☐☐☐☐	___%	___
Paid Aide ☐☐☐☐	___%	___
Vol. Aide ☐☐☐☐	___%	___
Other ☐☐☐☐	___%	___

Director ____________

Program Name ____________

Location ____________

2.1 Whole Class	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

2.2 Small Group	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

2.3 Individual	Inst.	Sup.
Teacher ☐☐☐☐	___%	___
Specialist ☐☐☐☐	___%	___
Paid Aide ☐☐☐☐	___%	___
Vol. Aide ☐☐☐☐	___%	___
Other ☐☐☐☐	___%	___

Director ____________

Program Name ____________

Location ____________

3.1 Whole Class	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

3.2 Small Group	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

3.3 Individual	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

Director ____________

Program Name ____________

Location ____________

4.1 Whole Class	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

4.2 Small Group	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%

4.3 Individual	Inst.	Sup.
Teacher ☐☐☐☐	___%	___%
Specialist ☐☐☐☐	___%	___%
Paid Aide ☐☐☐☐	___%	___%
Vol. Aide ☐☐☐☐	___%	___%
Other ☐☐☐☐	___%	___%